2007

Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System

2007 Annual Report

Biological Opinion on the
Operation of the Missouri River Main Stem System,
Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project,
and Operation of the Kansas River Reservoir System

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2007 Annual Report

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Acronym/Abbreviation	Phrase
BiOp	Biological Opinion on the Operation of the Missouri river Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System dated November 30, 2000, and amended December 16, 2003
cfs	cubic feet per second
˚C	degrees Celsius
cm	centimeter
Corps	U.S. Army Corps of Engineers
CRP	construction reference plane
CSRP	Comprehensive Sturgeon Research Project
dph	day post-hatch
EIS	Environmental Impact Statement
ESH	Emergent Sandbar Habitat
FTC	Fish Technology Center
FWG	Federal Working Group

FY	Fiscal Year
GIS	Geographic Information System(s)
GPS	Global Positioning System
IDA	Information and Data Advisory (Team)
kg	kilogram(s)
km	kilometer(s)
LH-RHa	Luteinizing Hormone-Releasing Hormone analogue
LiDAR	Light Detection and Ranging
MAF	million acre-feet
Master Manual	Missouri River Master Water Control Manual
MDC	Missouri Department of Conservation
Mitigation Project	Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Iowa, Nebraska, Kansas and Missouri
mg	milligram(s)
mm	millimeter(s)
MNRR	Missouri National Recreational River
MRERP	Missouri River Ecosystem Restoration Plan
MRRIC	Missouri River Recovery Implementation Committee
MRRP	Missouri River Recovery Program
msl	mean sea level
NCER	National Center for Ecosystem Restoration
NFH	National Fish Hatchery
NGPC	Nebraska Game and Parks Commission
NPS	National Park Service
NPWRC	Northern Prairie Wildlife Research Center
NWHC	National Wildlife Health Center
PDT	Product Delivery Team
PIT	Passive Integrated Transponder
plans and specs	plans and specifications
PPAP	(Pallid Sturgeon) Propagation and Population Augmentation Project
RM(s)	River Mile(s)
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
SDGFP	South Dakota Game, Fish and Parks
SFH	State Fish Hatchery
spp.	species within the genus (standard scientific abbreviation)
SRFM	Spring Rise Flow Modification
SWH	Shallow Water Habitat
System	Missouri River Main Stem System
USD	University of South Dakota
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Work Plan	Annual Work Plan
WRDA	Water Resources Development Act
YOY	young-of-year

2007 Annual Report

Biological Opinion on the Operation of the Missouri River Main Stem System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System

Introduction: The U.S. Army Corps of Engineers (Corps) has prepared this annual report for interested parties in accordance with reporting requirements of the Biological Opinion (BiOp) on the Operation of the Missouri River Main Stem System (System), Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System, prepared by the U.S. Fish and Wildlife Service (USFWS) dated November 30, 2000, and the Amendment thereto, dated December 16, 2003. This annual report also documents the Corps activities implemented under the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project, Iowa, Nebraska, Kansas and Missouri (Mitigation Project). Congress first authorized construction of the Mitigation Project in Section 601(a) of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662). Section 334(a) of WRDA 1999 (Public Law 106-53) modified the Mitigation Project by increasing the amount of acreage to be acquired and/or mitigated. The total amount of land authorized for mitigation is currently 166,750 acres.

This report documents Corps activities and progress in implementation of the elements of the Reasonable and Prudent Alternative (RPA), Reasonable and Prudent Measures (RPM), and Conservation Recommendations outlined in the 2000 BiOp and the 2003 Amendment for the federally listed threatened and endangered species on the Missouri River and activities implemented under the Mitigation Project for calendar year 2007. These activities were carried out as part of the larger Missouri River Recovery Program (MRRP). Only those items that are required for calendar year 2007 or have been accelerated in the BiOp schedule are included in this annual report. Activities described in this annual report are summarized below. A more detailed description of these activities is provided in the main document.

Section I, Missouri River Ecosystem Restoration Plan (MRERP) and Environmental Impact Statement (EIS), includes an introduction to what the MRERP/EIS is, its objectives, and work accomplished during 2007.

Section II, Habitat Creation, describes efforts involved with emergent sandbar habitat (ESH) creation, shallow water habitat (SWH) creation, floodplain development, and real estate acquisition along the Missouri River during 2007.

Section III, Flow Modifications, describes implementation of the Spring Pulse, Fort Peck Flow Modification, Unbalanced Intrasystem Regulation, and work accomplished on sediment studies during 2007.

Section IV, Science, describes the science-related activities on the Missouri River ecosystem and the native species, with focus on the federally listed pallid sturgeon (*Scaphirhynchus albus*), least tern – interior population (*Sterna antillarum*), piping plover (*Charadrius melodus*) and the bald eagle (*Haliaeetus leucocephalus*). A description of Adaptive Management is provided first followed by a summary of science-related activities for the pallid sturgeon, least tern and piping plover, and the bald eagle.

Section V, Public Involvement and Communications, provides information on efforts associated with the Missouri River Recovery Implementation Committee (MRRIC), the Information and Data Advisory (IDA) Team, and the Communications Plan.

I. Missouri River Ecosystem Restoration Plan and Environmental Impact Statement (WRDA 2007 Section 5018 Study)

Subsection (a) of Section 5018 of WRDA 2007 directs the Secretary of the Army, in consultation with the MRRIC, to conduct a study of the Missouri River and its tributaries to determine actions required to:

1. Mitigate losses of aquatic and terrestrial habitat;
2. Recover federally listed species under the Endangered Species Act; and,
3. Restore the ecosystem to prevent further declines among other native species.

The MRERP study team partnered with leadership at the District and Division level to draft "implementation guidance" for this study. At the time of this report, implementation guidance was undergoing Headquarters review.

II. Habitat Creation

II.A. Emergent Sandbar Habitat Creation Activities

II.A.1. Vegetation Removal Projects

Two contracts were awarded to cut down and shred dead vegetation on sandbars from Lake Oahe, below Fort Randall Dam, Lewis and Clark Lake, and below Gavins Point Dam. Table 1 shows sandbar location and acreage amount.

Table 1. Sandbar Location and Acreage Amount

Sandbar Location	Acres
Lake Oahe	145.0
Below Fort Randall	13.2
Lewis and Clark Lake	81.0
Below Gavins	305.9

One hundred of the Lake Oahe vegetation removal acres were accomplished by a multi-project hired labor crew consisting of Gavins Point, Fort Randall, and Lake Oahe personnel.

Photograph 1. Hired Labor Crew Member Utilizing Timber Ax Attachment to Shred Woody Vegetation in Lake Oahe

A multiagency vegetation management product delivery team (PDT) was formed in summer 2007 to analyze vegetation removal efforts to date. The PDT decided on a temporary moratorium on further vegetation removal until the PDT could define a process to collect data, analyze results, and to make recommendations on efficacy of vegetation removal methodologies thus far.

II.A.2. Dredge Projects

Construction commenced in September and October 2007 on three sandbar complexes below Gavins Point Project. The sandbars are located at river miles (RMs) 791.5, 777.7, and 774. The sandbar created at RM 791.5 will be 40 acres and will be accomplished using a combination of backhoes, dozers and scrapers. The complex at RM 777.7 will create a 74-acre sandbar and also includes construction of a 15-acre backwater area. Dredging

is the primary construction methodology being utilized at this site. Final shaping of the dredge material will take place utilizing heavy equipment. The complex at RM 774 will be 49 acres and will also be constructed using a combination of backhoes, dozers and scrapers. All construction will be complete by April 15, 2008. Project identification for these sandbar complexes were generated by the first annual multiagency project identification PDT held during summer 2006.

Photograph 2. Dredge at RM 777.7

Work resumed in late winter 2007 on the construction of two sandbar complexes in Lewis and Clark Lake at RM 827. Original construction began in fall 2006. ESH creation timelines are constrained by the times of the year when the birds are present. The birds are present from mid- to late-April through mid-August. Construction can only occur between August and April after the birds have migrated out of the area. Construction usually commences in August and contractors work until ice conditions prevail. Contractors typically demobilize for the winter and resume work in the later winter or early spring when the ice conditions no longer exist. Contractors utilized a dredge to place the sand and heavy equipment to shape the sandbar. The contractor worked until the least terns and piping plovers arrived in April then resumed work in August after the birds left. The initial sandbar complex was completed in October 2007 creating a 116-acre complex at lake elevation 1206 feet mean sea level (msl). Work continues on the second complex that is estimated to create 135 acres. The second complex will be complete by April 15, 2008.

II.A.3. Coordination for Future Projects

Two multiagency project identification boat trips were held in 2007. The purpose of the trips was to identify potential projects for the 2008 construction season. The first trip was scheduled for June 5-6, 2007, and covered the Fort Randall reach, Lewis and Clark Lake, and below Gavins Point reach. Participating agencies were the Corps, the USFWS, the National Park Service (NPS), and the State of South Dakota. On June 5, 2007, the scheduled river trip had to be cancelled due to high winds. A meeting took place instead in the Niobrara State Park Lodge, utilizing maps to discuss potential project locations. On June 6, 2007, weather was more cooperative, and the team was able to tour the river and discuss project locations.

The second multiagency project identification boat trip took place on July 10-11, 2007. The team was comprised of Corps, USFWS, State of North Dakota Wildlife Office, and the State of North Dakota Water Commission personnel. The team toured and identified ESH projects above and below Bismarck, North Dakota.

Projects identified in the two meetings were prioritized by the multiagency team and submitted for programmatic budget ranking by the Corps. The projects were then ranked with all the other MRRP projects by a Corps senior level management team in August 2007. The fiscal year (FY) 2008 Work Plan included four construction sites for the 2008 construction season.

II.A.4. Programmatic Environmental Impact Statement

Programmatic Environmental Impact Statement work products for 2007 include preliminary drafts of the construction appendix, recreation appendix, three sections of the bird appendix, and completion of the Geographic Information System (GIS) database, including habitat delineations for digital ortho quads taken during 1998 and 2005. Sensitive resources received by request from agencies in Montana, North Dakota, South Dakota, and Nebraska were also added to the GIS database.

Cooperating agencies participated in the review of several of the contracted work products. A cooperating agency meeting was held on May 3, 2007.

II.A.5. Missouri River Emergent Sandbar Habitat Evaluation

In 2007, the Corps implemented a project to monitor and evaluate created and manipulated sandbar habitat complexes to determine if the physical and biological requirements of the birds are being met. A monitoring PDT was created to assist in the development of a monitoring process for the ESH Program and the U. S. Geological Survey (USGS) was contracted to write an ESH monitoring plan.

The Missouri River ESH Monitoring Plan (Sherfy et al. 2007) was developed and finalized in 2007 and provides a general framework for collection of biological data in support of the monitoring needs of the ESH Program. The ESH Monitoring Plan emphasizes nesting habitat for least terns and piping plovers, because those are the desired end goals of management under the ESH Program, and least terns and piping plovers are the target resource.

In 2007, an annual work plan (Work Plan) was compiled to address target resource needs, as well as other identified response variables. The Work Plan provided the structure to accommodate all activities being implemented to evaluate the ESH Program. Each of these activities was identified in a guiding document or process, and protocols were written directly into the Work Plan. The 2007 Work Plan outlined the current and ongoing efforts being implemented during the 2007 nesting season to evaluate ESH projects, as well as provided guidance to field crews on collecting data to accomplish the monitoring needs identified in the ESH Monitoring Plan. Specific goals and objectives were identified for the 2007 season and were addressed in the Work Plan. Monitoring and surveying of specific variables, which were identified as a high priority by our cooperating agencies, were also included in this document.

II.A.5.a. Goals and Objectives

The goal of ESH evaluation during 2007 was:

To determine if managed ESH is providing suitable habitat features for nesting and foraging least terns and piping plovers, while not being deleterious to other ecosystem functions or social values.

To accomplish this goal, three objectives were addressed in the 2007 Work Plan: 1) evaluate the effects of ESH projects on nesting and foraging habitat and productivity of least terns and piping plovers; 2) identify potential important collateral effects of ESH projects on other ecosystem attributes or social values; and 3) examine linkages between habitat features and productivity in relation to ESH projects to provide guidance for future project planning and design.

The Work Plan provided guidance on collection of data needed to address the objectives. Sampling included spatial (remote sensing), habitat (terrestrial and aquatic), physical, productivity, and biological data. Collectively, these data will provide information on quantity and quality of habitats, enabling an integrated approach to evaluating system responses to ESH projects.

A second mussel roundtable meeting jointly hosted by the Corps, the USFWS, and the NPS was held at the NPS Regional Office in Omaha on October 22, 2007. The meeting was a followup to the initial mussel roundtable meeting held on June 13, 2006. The followup meeting was held to discuss the final comprehensive mussel survey report dated June 2007, and future mussel survey needs on the Missouri National Recreational River

(MNRR) reaches. It was decided at the meeting to continue to perform site specific mussel surveys on the projects identified for late summer and early fall 2008 ESH construction projects. Those surveys took place in November 2007. When results of those surveys are received, further discussions will take place to determine if any future mussel surveys will be required.

II.A.5.b. Target Resource Monitoring: ESH Habitat Evaluation

Sampling locations were selected based on the best available current information on locations of previously constructed ESH projects and locations where ESH projects are likely to be implemented after the 2007 nesting season. In accordance with the ESH Monitoring Plan (Sherfy et al. 2007), the sampling segments for ESH were 0.4-RM segments on four riverine segments. Sampling segments were selected by scientists at USGS – Northern Prairie Wildlife Research Center (NPWRC), based on a suite of variables identified in the ESH Monitoring Plan. Nineteen segments were sampled on Lake Oahe, 14 on the river below Fort Randall Dam, 13 on Lewis and Clark Lake, and 41 segments on the river below Gavins Point Dam. Six segments on Gavins Point, one on Fort Randall, and one on Lewis and Clark Lake were not sampled due to habitat loss from 2006 to 2007 or due to access issues.

Terrestrial habitat conditions on each river segment were quantified by measuring a suite of habitat variables at 30 sampling points within each sampling segment and at each nest within each sampling segment. Nest location and fate data were also collected at each nest within the sampling segments. Invertebrate samples were taken at five of the points falling in wet sand. Points were selected by USGS-NPWRC to represent the principal habitat types used for nesting and were allocated among the habitat types in proportion to their abundance within the segment.

Aquatic habitat conditions and the fish community were sampled by USGS-NPWRC in a subset of the segments. Sampling was conducted at 10 points randomly selected from the available open water within each segment. Fish samples were collected at 3 of the 10 points.

II.A.5.c. Analysis

Analysis of data will be conducted by USGS-NPWRC and completed by late February 2008. A final report will be available by late March 2008, summarizing the findings of the habitat evaluation. The analysis will attempt to answer the following questions: 1) how does quality of nesting habitat compare among sampling segments containing created, modified, and natural sandbars; 2) how does foraging habitat compare among segments containing created, modified, and natural sandbars; 3) what are the differences in responses to modification projects over time; and 4) what is the quality of habitat on the sampled Missouri River reaches?

II.B. Shallow Water Habitat Creation Activities

II.B.1. Omaha District Design Activities

A number of SWH design activities were completed in 2007. A summary is provided below.

1. Boyer Bend Backwater: Completed 60 percent of plans and specifications (plans and specs). This area is on the left bank from RM 635.5 to 634.1. It consists of a linear backwater parallel to the river with numerous slope variation areas. The upstream end of the backwater area ends near the river but does not include a direct connection. The approximate backwater area is about 43 acres.

2. Bullard Bend: Completed 60 percent of plans and specs. This project includes a backwater connection that is near RM 663.1. The backwater is a linear backwater parallel to the river with an average width of about 300 feet. The plan includes numerous side slope variations. The approximate backwater area is about 25 acres.

3. Lower Calhoun Chute: Completed concept plan. This chute is a left bank chute about 2,800 feet in length near RM 637.5. The chute includes a main chute with a bottom width of 76 feet and two higher level chutes that braid through the main chute. Several areas with gradual side slope are also included.

4. Fawn Island: Completed plans and specs. Fawn Island is a left bank chute near RM 673.6. The length of the chute is approximately 0.5 mile and includes a bottom width of 150 feet.

5. Middle Decatur Bend: Completed 60 percent of plans and specs. This project is a right bank chute from RM 688.2 to 687.5. Chute length is approximately 4,400 feet with a bottom width of 75 feet. The upper 3,000 feet of the chute includes a 10H on 1V constructed side slope.

6. Plattsmouth Bend Backwater Phase II within the Schilling Wildlife Management Area: Completed plans and specs. This backwater connects to the previously constructed habitat features off the Plattsmouth chute and backwater. The backwater area contains numerous slope variations with variable width.

7. River Structure Control Modifications from Sioux City to Rulo: Completed plans and specs. This work is a continuation of previous activities. Activities this year included the development of two separate design packages for the construction of reverse sills, chevrons, and dike modifications at intermittent locations.

8. Tobacco Island Chute: Completed design revisions. This chute has not functioned as designed since construction several years ago. Chute length is over 15,000 feet. The design revision consists of constructing a minimal width pilot channel at the original design grade. The restored invert is 2 to 3 feet lower than the current chute invert elevation.

II.B.2. Omaha District Construction Activities

The Omaha District had three SWH construction activities that were completed in 2007. A brief description of each activity is provided below.

1. Council Bend: This project consisted of a left bank chute from RM 616.7 to 618.2 on the east side of Council Bluffs, Iowa. Chute length is about 5,630 feet. Constructed chute bottom width varies from 150 to 180 feet. The project included several beneficial uses developed through collaboration with other agencies, including stockpiling excavation material for future use by the Iowa Department of Transportation. The chute was also designed to provide adequate buffer distance between the chute flows and the existing Federal levee protecting the city of Council Bluffs so that it would pose no threat nor operation and maintenance burden to that levee project. This project resulted in the construction of about 18 acres of SWH.

Photograph 3. Council Bend Chute, RM 616.8

2. River Control Structure Modification from Sioux City to Rulo: A contract was issued for river control structure modifications in the reach from Sioux City downstream to Rulo. Typical structure modifications included reverse sill, dike lowering, and chevrons. Work ceased in October 2007 due to low river levels.

Construction completion of this project is estimated as June 2008. Structure modifications constructed this season will result in the creation of about 24 SWH acres when fully developed.

3. Desoto Bend Revetment Notching: A series of revetment notches were constructed at Desoto Bend from RM 644.5 to 641.8. Twelve different locations of the bank revetment were notched. Several different revetment notching concepts were utilized at the different locations. The typical revetment notch included the removal of revetment sections with an area excavated into the bank behind the revetment. Some bank erosion is expected in this area. This project will provide about 10 acres of SWH once the notches are fully developed.

II.B.3. Kansas City District Design Activities

A summary of the design activities for SWH in 2007 within Kansas City District is provided below.

1. Lower Barney Bend Chute: Completed plans and specs. The project consists of a single flow-through chute of approximately 9,000-foot length on the left bank from RM 549.5 to 547.4. Four rootless dikes are to be constructed at wide spots along the chute alignment. The project is expected to create approximately 46 acres of SWH when fully developed.

2. Baltimore Bottoms Chute A and Dike Extensions (the second phase of construction of the Baltimore Bottoms Chutes Project on the right bank from RM 300 to 297): Completed 65 percent of plans and specs. Chute A is approximately 12,665 feet long, and includes breaching the former Hodge Bottoms non-Federal levee and reconnection of 1,060 acres to the floodplain. Material from the chutes will be utilized to create sandbars. Eight dikes to be extended between 40 to 120 feet, the end portions of five dikes to be raised 4 feet, and two new notches excavated near the bank, together with the eight bank notches and two dike notches excavated in 2004 along this reach, are designed to create a reverse sill shape. The planned dike extensions are designed to create and maintain sandbars within the dike fields, while mitigating for the flow diverted from the navigation channel through the chutes and SWH along the river bank. Together with the first phase of construction (Chutes B and C), the project is expected to create approximately 100 acres of chutes and 80 acres of sandbars when fully developed.

3. Wolf Creek Chute: Completed a conceptual design on the left bank from RM 480.5 to 478.5. The project alternatives will include multiple entrances, rootless dikes in the chute, woody debris anchored in the chute, and varying cross-sectional shapes, including elevation benches and side slope changes.

4. Dalby Bottoms: Began preliminary design work on right bank from RM 420 to 415. Project alternatives will include SWH development, reverse sills, bank notches, and various chute configurations.

II.B.4. Kansas City District Construction Activities

The Kansas City District had seven SWH construction activities that were started in 2007. A brief description of each activity is provided below.

1. Baltimore Bottoms Chutes B and C: The Corps-hired labor crews completed construction of 20 percent of Chutes B and C (the first phase of construction for the Baltimore Bottoms Chutes Project, RMs 300 to 297). Chute B is designed to flow directly into Chute C while connecting to the natural chute near RM 298.5, creating two new islands and four sandbars when completed as shown in Figure 1. Total length of Chutes B and C is 9,580 feet. Construction of the project is currently on hold.

Figure 1. Baltimore Bottoms Chutes B and C Site Plan

Photograph 4. Grading Baltimore Sandbar/Disposal Area, February 21, 2007

2. Baltimore Bottoms SWH: Corps-hired labor crews completed a 1,720-foot-long revetment chute at RM 300.7 and completed 50 percent of a bank notch on Dike-305.5 at RM 300.2. The project is expected to create approximately 10 acres of SWH when completed. Construction of the project is currently on hold.

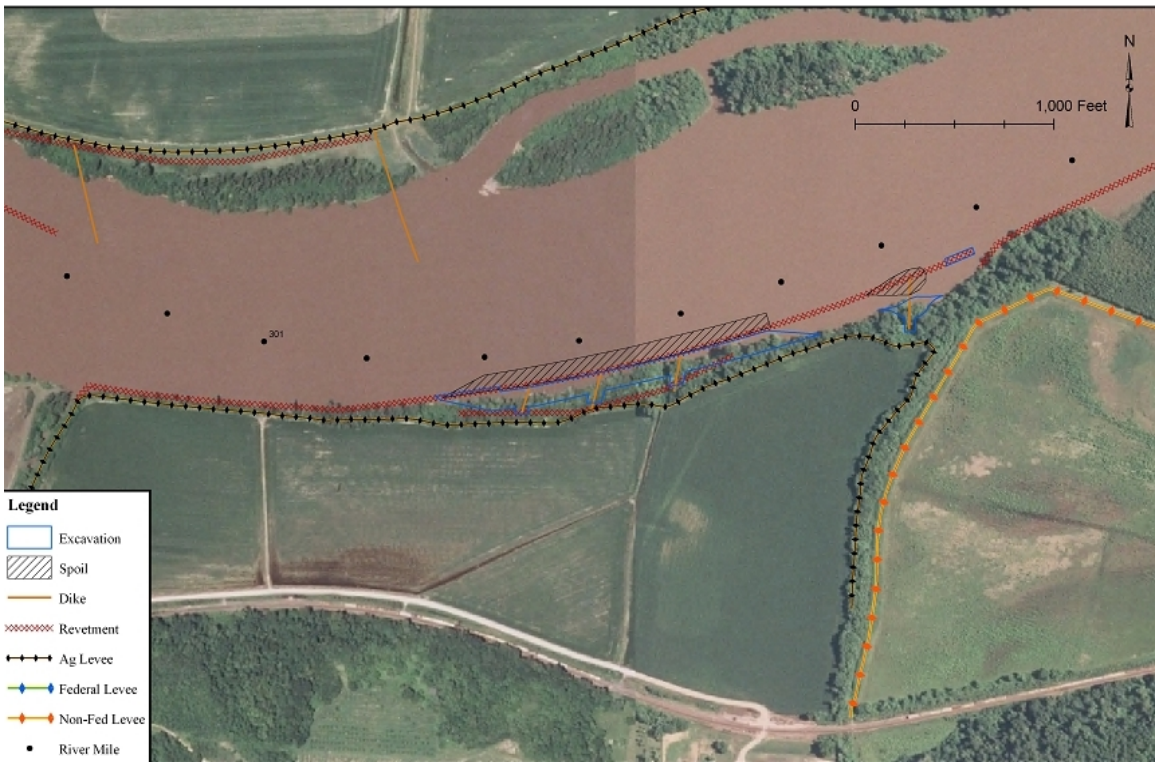
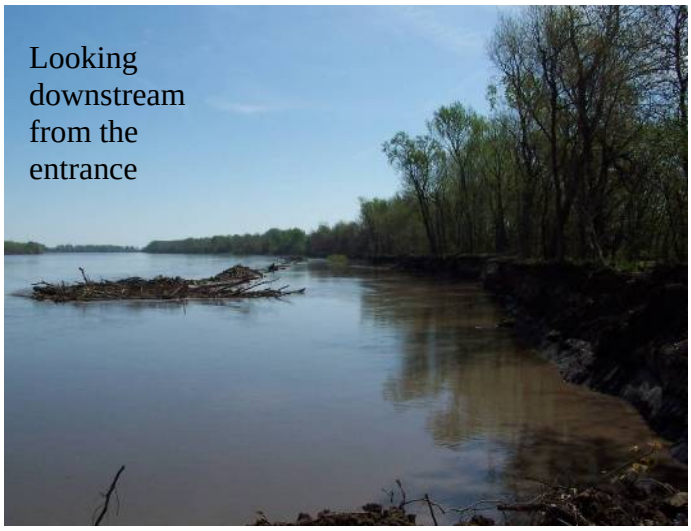


Figure 2. Baltimore Bottoms SWH Site Plan



Photograph 5. Baltimore Completed Revetment Chute on April 30, 2007

3. Jameson Island Chute: Corps-hired labor crews completed 30 percent of the excavation of a 9,830-foot-long chute. During construction, the outlet location was relocated downstream, increasing length to 10,200 feet, with 370 feet of the original chute exit to remain partially excavated. A tabletop physical model, or micro model, of the chute was constructed by St. Louis District to view how sediment from the project would move through the river and to test whether flow from the chute could impact agriculture levees in the area. The construction contract was terminated for convenience in November 2007. Construction of the project is currently on hold.

Photograph 6. Partially Completed Jameson Island Chute on May 5, 2007, During Flood

4. Rush Bottom Chute: Corps-hired labor crews continued excavation of an 8,276-foot-long chute between RM 500 to 501.7. Construction of the project is currently on hold at 95-percent completion.

Photograph 7. Looking Downstream from Dredge Location at Rush on September 20, 2007

5. Tarkio River Chutes: The project consists of two chutes of 2,063-foot and 1,483-foot lengths connected to the Tarkio River, as well as widening of the Tarkio River mouth for a length of 1,045 feet. The project will create two new islands and approximately 8 acres of backwater habitat following construction. Construction of the project is currently on hold at 0.0-percent completion.

Figure 3. Tarkio River Site Plan

6. Howell Island Dike Extensions: Corps-hired labor crews extended dikes at Howell Island between RM 45 and 50. The additional dike length was constructed to create sandbars behind the dikes. The new construction was placed at variable elevations, as summarized below, so that there would be diversity in the new habitat. A total of six dikes were extended from 50 to 100 feet in length. Completed work was designed to complement the 19 notches excavated along the site in 2003. The 2007 Howell Island structure modifications include the following in Table 2 below.

Table 2. Howell Island Dike Extensions

Dike	RM	Dike Extension
Dike 46.65:	46.0	100-foot dike extension at +2 CRP (2-feet above construction reference plane (CRP))
Dike 46.7	46.2:	100-foot dike extension at +2 CRP
Dike 47	46.5:	100-foot dike extension at +2.5 CRP, 50-foot notch at -5 CRP (5 feet below CRP)
Dike 47.2	46.7:	100-foot dike extension at +0 CRP, 85-foot notch at -6 CRP
Dike 47.9B	47.1:	50-foot dike extension at +2 CRP
Dike 47.95	47.4:	50-foot dike extension at +2.7 CRP

Photograph 8. Construction of Howell Island Dike Extensions via Floating Plant

7. Dike Notching: Corps-hired labor crews performed some lowering and widening of old (pre-1990) dike notches. Notches lowered had become perched due to channel degradation.

III. Flow Modifications

In December 2006, the Corps prepared the Annual Operating Plan, which presents information regarding the Corps'regulation of the System through December 2007. The information provided in the Annual Operating Plan is based on water management guidelines designed to meet the regulation objectives of the Missouri River Master Water Control Manual (Master Manual). The results of this flow management, with regard to compliance with RPA elements of the BiOp, will be described in the Missouri River Mainstem System Summary of Actual 2007 Regulation report (in press). The System document, "System Description and Regulation," published in November 2007, presents a summary of pertinent data and a description of the System and discusses the regulation of the System to serve the Congressionally-authorized project purposes. The Missouri River Basin Water Management Division, located in Omaha, Nebraska, directs the regulation of the System to serve the Congressionally-authorized project purposes of flood control, navigation, hydropower generation, irrigation, water supply, water quality control, recreation, and fish and wildlife.

III.A. Spring Pulse

The technical criteria presented in the Master Manual includes provisions for two 'spring pulses' out of Gavins Point Dam, one in March and another in May. These technical criteria also include System storage 'precludes' for each of the spring pulses to be measured on 1 March and 1 May of the year. The spring pulse technical criteria, which was added to the Master Manual in 2006, calls for both these precludes to be set at a System storage of 36.5 million acre-feet (MAF) until the first of each pulse is implemented. After the initial year of implementation of either the March or May spring pulse, the precludes change to 40 MAF.

Storage was below 36.5 MAF on March 1, 2006, and on March 1, 2007, so an initial March pulse has not been implemented. The March spring pulse, with peak releases of 5,000 cubic feet per second (cfs) above navigation service flows coinciding with the start of the navigation season, is of similar magnitude but shorter duration than the channel conditioning flows used at the start of the navigation seasons in the past.

Storage was above 36.5 MAF in 2006, so a May spring pulse was implemented and the storage preclude was increased to 40 MAF. System storage was below 40 MAF on May 1, 2007, so a May pulse was not implemented in 2007.

Additional information on the spring pulse criteria is included in the Missouri River Main Stem Reservoir System document, "System Description and Regulation," published in November 2007. A summary of 2007 regulation of the System will be included in the document, "Summary of Actual 2007 Regulation," which is being prepared as this report is being finalized.

III.B. Fort Peck Flow Modification and Unbalanced Intrasystem Regulation

The Fort Peck 'mini-test' and unbalancing the upper three reservoirs were not implemented in 2007 and will not be implemented in 2008 due to low System storage. Both of these plans may be implemented when System storage recovers to more normal levels.

III.C. Sediment Studies

III.C.1. Lewis and Clark Lake Sediment Management Study Update

The Lewis and Clark Lake Sediment Management Study has been developed by the Omaha District in response to the statement of intent in the 2003 Amendment to the BiOp on page 213, the RPA to "research and develop a way to restore the dynamic equilibrium of sediment transport and associated turbidity in river reaches downstream of Fort Peck (Segment 2), Garrison (Segment 4), Fort Randall (Segment 8), and Gavins Point Dams (Segment 10), and stop or reverse bed degradation of the river."

The study is scheduled to develop numerical modeling tools to predict changes in the reservoir reach from Ft. Randall Dam to Gavins Point Dam caused by varying flows and lake levels. The model will attempt to predict the movement of sediments in the reservoir reach and predict the extent of any sediment transport to below Gavins Point Dam. A downstream model will use the results of the reservoir model to estimate changes in the MNRR reach from Gavins Point Dam to Ponca State Park. The model will extend to Sioux City, Iowa, to evaluate impacts to the upper navigation channel. Study inception was May 2006, with an expected completion date of September 2009. As of November 2007, new surveys of the entire reach to be modeled have been completed and delivered to the Corps. The surveys will be integrated into the GSTARS3-HTC reservoir model by spring 2008 and into the HEC-6T downstream model. GSTARS3-HTC is a numerical (computer-based) quasi-2 dimensional reservoir sedimentation model, and HEC-6T is a 1 dimensional riverine flow and sediment transport model.

Agency and public meetings were held in June 2007 to solicit input on the goals and scope of the study. Alternatives are being developed from this input, and these alternatives will be evaluated with the models in late 2008.

IV. Science

IV.A. Adaptive Management

Adaptive Management was formally assigned to Corps and USFWS personnel in December 2006. In 2007, USFWS and Corps personnel put together an Adaptive Management Workshop for the managers of the two agencies. The purpose of the workshop was to use the understanding and lessons from other areas to foster the application of adaptive management to the Missouri River.

The workshop, involving 40 managers and staff of the Corps and the USFWS, was held on March 5, 2007, to hear about adaptive management experiences from programs involving the Glen Canyon/Colorado River, Illinois River, Kissimmee River, and Missouri Natural Areas. Participants listened to the following lessons learned:

1. Persistence is needed, because there are no short-term quick fixes;
2. Leadership is required to explore new ways to carry out agency mandates and legislative priorities;

3. Integrating science and management can more quickly achieve societal goals;
4. Stakeholder engagement is difficult, but crucial; and
5. An adaptive form of governance that builds trust and commitment through learning and shared risk-taking is required.

Although adaptive management can create new and novel approaches to chronic problems, those solutions require ecological resilience, social and political flexibility, and integrative science.

To implement adaptive management on the Missouri River, a number of issues will need to be addressed. Assumptions about how the river is currently managed should be reviewed. Processes should be developed to bring together integrative science with conventional engineering-based planning prior to developing new policies that can be tested through actions. An understanding of what data and information sets are available is also needed. Engagement of a diverse set of stakeholders across the length and width of the river basin is another pivotal challenge. During the workshop, the managers explored the need for new institutions such as stakeholder advisory groups, scientific and technical advisory groups, and public engagement programs along the Missouri River corridor. Building trust and social capital through partnering was recognized as a key issue. Fitting adaptive approaches into existing agency protocols and cultures, especially legislation such as the Endangered Species Act or the National Environmental Policy Act, can be problematic and contested. The positive news is that all of these challenges can be addressed and surmounted, as other successful efforts have demonstrated.

One way forward would be to develop two separate but linked projects. The first project would select a priority area such as the Gavin's Point Dam, which would then be used as the focus of a series of adaptive environmental assessment workshops to address a pressing issue there. These workshops would develop and build a conceptual science-based model to integrate understanding and develop adaptive management experiments to test alternative ways of resolving the problems within that priority area. The second project would be a system-wide scenario project that seeks to evaluate the entire river system in terms of the sensitivity of current and proposed management plans to global ecological drivers (such as climate change), economic drivers (like shifting agriculture in the Midwest), and social considerations. Both projects are highly instructive and broadly applicable management actions and planned learning exercises in implementing adaptive management.

IV.B. Pallid Sturgeon Summary

IV.B.1. Population Assessment

The Pallid Sturgeon Population Assessment Program has been developed by the Pallid Sturgeon Population Assessment Team (PSPAT). The team (Figure 4) is comprised of representatives of State and Federal agencies and academia that collectively possess knowledge and expertise of the Missouri River, pallid sturgeon and native Missouri River fishes, research, experimental design, and statistical analysis.

The program focuses on the endangered pallid sturgeon and a series of native Missouri River species as required in the BiOp.

IV.B.1.a. Objectives of the Project

1. Evaluate annual results and long-term trends in pallid sturgeon population abundance and geographic distribution throughout the Missouri River System.

2. Evaluate annual results and long-term trends of habitat usage of pallid sturgeon and hatchery-stocked pallid sturgeon by season and life stage.

3. Evaluate population structure and dynamics of pallid sturgeon in the Missouri River System.

4. Evaluate annual results and long-term trends in native target species population abundance and geographic distribution throughout the Missouri River System. These target species include: shovelnose sturgeon (*Scaphirhynchus platyorynchus*), blue sucker (*Cycleptus elongatus*), sauger (*Zander canadense*),

plains and western silvery minnows (*Hybognathus* spp.), sand shiner (*Notropis stramineus*), and three main channel inhabiting cyprinids in the genus *Macrhybopsis:* sturgeon chub (*M. gelida*), sicklefin chub (*M. meeki*), and speckled chub (*M. aestivalis*). These three chub species are the main forage for piscivorous pallid sturgeon and are rare themselves in some sections of the Missouri River.

5. Evaluate annual results and long-term trends of habitat usage of the target native species by season and life stage.

6. Evaluate annual results and long-term trends in all remaining species (minimum of 50 fish collected per species) population abundance and geographic distribution throughout the Missouri River System.

Figure 4. Pallid Sturgeon Population Assessment Team

IV.B.1.b. Project Area and Status Update

Although implementation was initiated in 2001, 2007 marked the second year of full implementation throughout the project area. The project area includes the riverine reaches of the Missouri River extending from Fort Peck Dam, Montana, to the confluence of the Missouri and Mississippi Rivers near St. Louis, Missouri and the Kansas River from the Highway 7 Bridge to the confluence of the Kansas and Missouri Rivers.

IV.B.1.c. Independent Science Review

Sustainable Ecosystems Institute conducted an independent science review in 2004 and a power analysis of the Pallid Sturgeon Population Assessment Project in 2007. Recommendations from the review have been incorporated into the project.

IV.B.1.d. 2007 Power Analysis

A detailed power analysis is being conducted in 2007 to evaluate data collection against addressing the project's objectives. Results of this power analysis will be posted, along with annual reports, on the website at www.moriverrecovery.org.

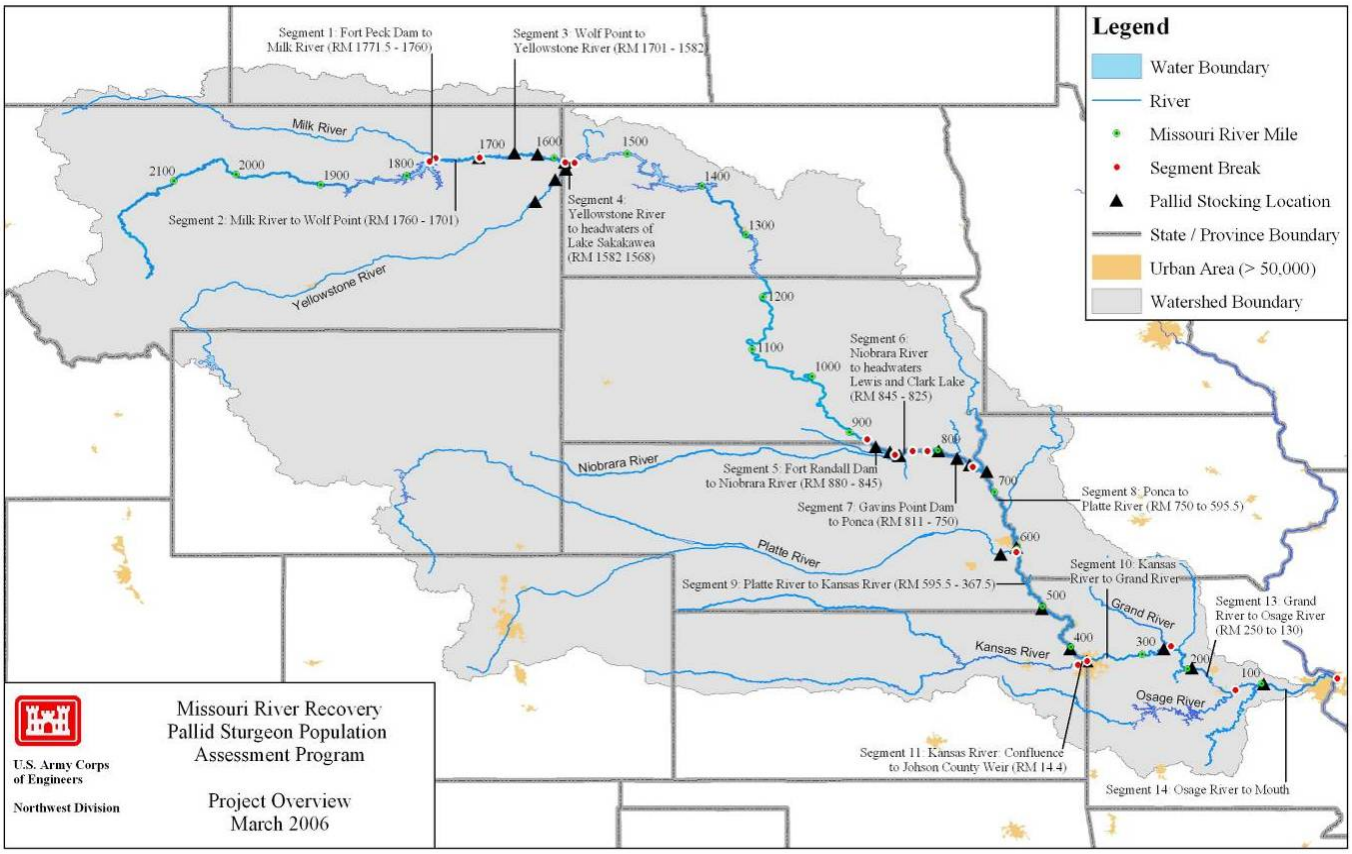


Figure 5. Missouri River Population Assessment Program Map
(Segment 12 was combined with segment 13 effective July 1, 2005.)

IV.B.1.e. 2007 Summary Reports

The standardized reports for each segment (i.e. 1 through 14) and comprehensive project reports will be available on the website at www.moriverrecovery.org, listed under "Publications and Reports," which is currently under development

A standardized reporting template has been developed by the Pallid Sturgeon Population Assessment Team, providing an overview of the findings in each segment for pallid sturgeon and the target native species under evaluation for this project. All tables and figures between segment reports are standardized, facilitating easy comparisons between segments for the standard sampling requirements of the program. Additional data collection efforts above and beyond the standard requirements of the program are also included in appendices within these reports.

IV.B.2. Propagation and Population Augmentation Project (PPAP)

The Pallid Sturgeon PPAP utilizes six hatcheries throughout the Missouri River basin to meet the stocking needs of the species. These hatcheries include the Blind Pony State Fish Hatchery (SFH) in Sweet Springs, Missouri; the Neosho National Fish Hatchery (NFH) in Neosho, Missouri; the Gavins Point NFH in Yankton, South Dakota; the Garrison Dam NFH in Riverdale, North Dakota; the Miles City SFH in Miles City, Montana; and the Bozeman Fish Technology Center (FTC) in Bozeman, Montana.

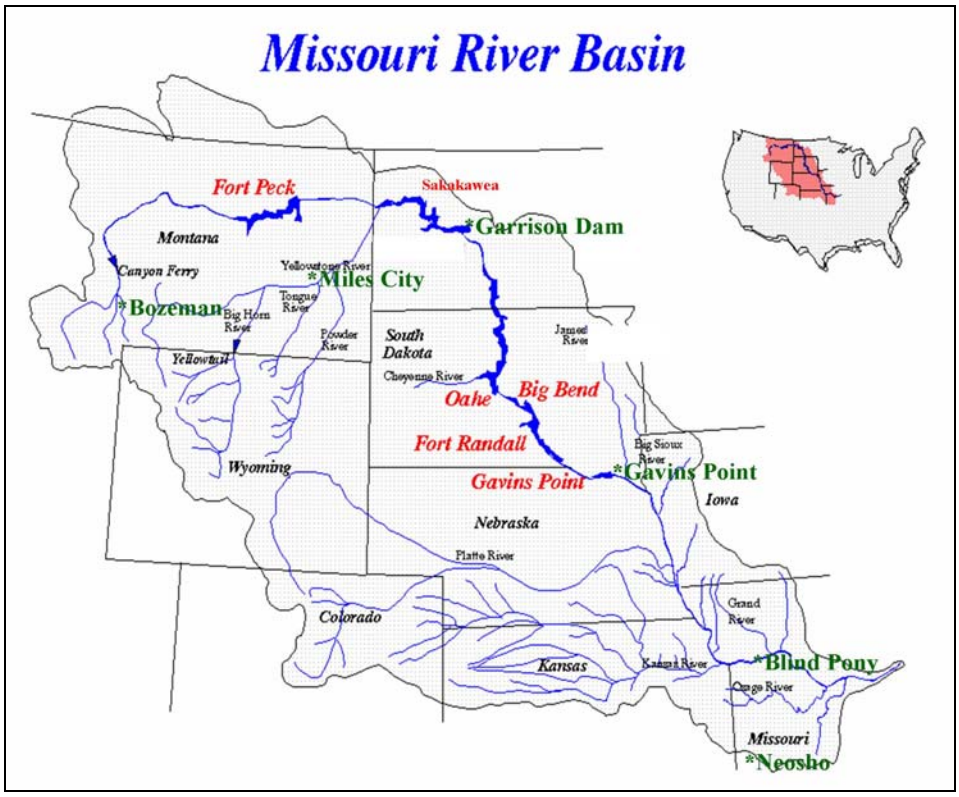


Figure 6. Locations of the Propagation and Population Augmentation Project's Cooperating Hatcheries

The PPAP consists of two primary components at the present time. The annual supplemental support component, as derived based on the BiOp, and the facility improvements component, as outlined in the Corps' 2003 Missouri River Biological Assessment. The annual supplemental support component of the PPAP provides resources to each of the participating hatcheries, as determined by the PPAP's PDT, to ensure the most equitable use of the PPAP's resources to meet the stocking needs of the species. The intent is not to replace resources from these participating hatcheries, but to provide supplemental support to increase the overall capabilities and success of the augmentation effort. The facility improvements component of the PPAP is a short-term approach to addressing limitations of the hatcheries in meeting annual stocking targets. The intent of this component is to increase the quantity and the quality of the hatchery-produced pallid sturgeon to more effectively fulfill the stocking goals in each of the recovery management units within the Missouri River System. The facility improvements component has been completed with the exception of addressing reliable power to the Garrison Dam NFH. The combination of these two programmatic components enables the effort to focus on the population augmentation needs of the pallid sturgeon relative to recovery of the species.

Pertaining to all of the facilities, a portion of the annual supplemental support offsets costs associated with feed, utilities, distribution costs, water filtration and disinfection, and various maintenance items and operational costs incurred through the facility improvements component of the program.

The benefits of a collective approach to capturing, spawning, and rearing pallid sturgeon is critical to the overall success of the PPAP. Multiagency cooperative efforts put forth targeting broodstock collection efforts in North Dakota in fall 2006 and spring 2007, resulting in the capture of 13 female and 28 male pallid sturgeon. In the lower Missouri River basin (Gavins Point Dam to the mouth), monitoring and research crews captured a total of 16 wild fish that were transported to hatcheries for evaluation potential as broodstock. Of eight fish at the Gavins Point NFH, seven were mature males and one was a reproductively ready female. Of eight fish at the Neosho NFH, two males and one black-egged female were determined to be in reproductively ready condition.

Collectively, a total of 54 family crosses were generated through the propagation effort, 51 families representative of the upper Missouri River basin (i.e., North Dakota and Montana) and 3 families representing the lower Missouri River basin. In addition to the success of the 2007 spawning effort, two female pallid sturgeon were dedicated to high priority research and therefore were not included in the propagation effort. These fish were tagged with the Combined Acoustic and Radio Tags and released back near their capture point. These fish were subsequently tracked, and both females released their eggs in the Yellowstone River.

In addition to the two female pallid sturgeon that were tagged and tracked in the upper basin, two female pallid sturgeon were also tagged and tracked in the Gavins Point Dam to Platte River reach. One of these females moved upstream into the unchannelized recreational river stretch above Ponca, Nebraska, and released her eggs; and the second female moved upstream and released her eggs in the channelized section of the river near Sioux City, Iowa.

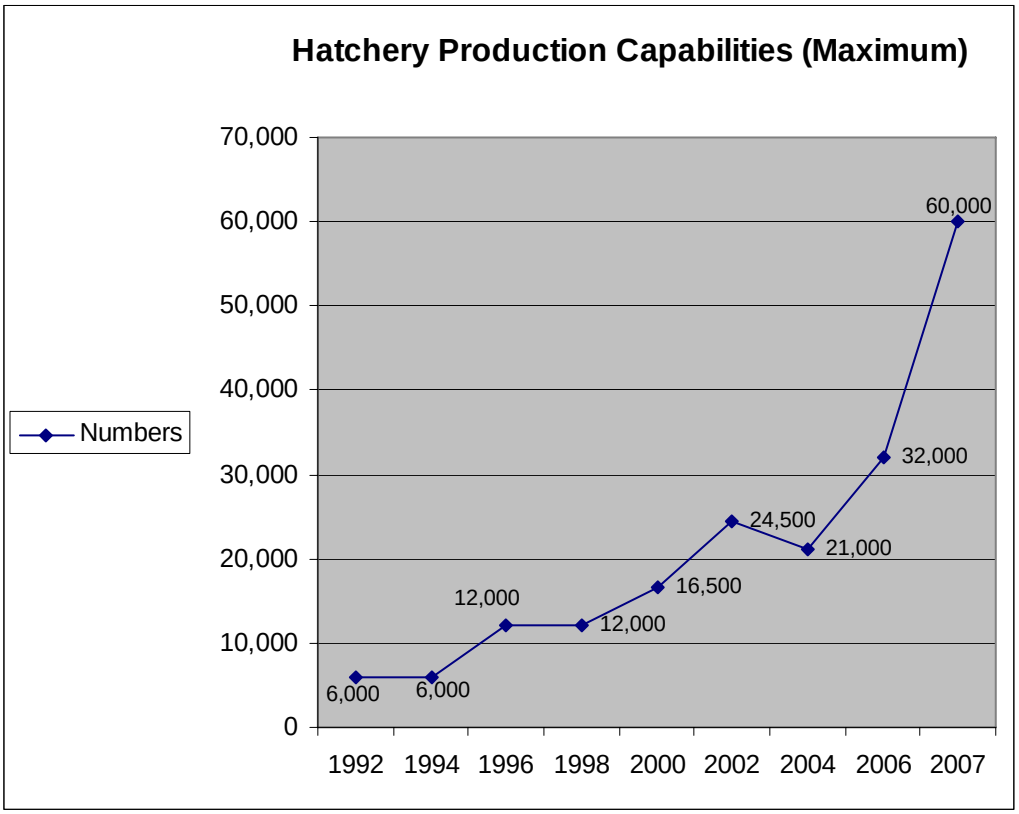


Figure 7. Maximum Hatchery Production Capabilities for the Gavins Point, Garrison Dam, Miles City, Blind Pony, and Neosho Hatcheries and the Bozeman FTC Collectively

Figure 7 is based on maximum allowable densities of 0.5 pounds of fish per square foot of rearing space and fish length of approximately 8 inches (fork length). Note that the hatcheries will operate at densities below the recommended maximum allowable levels to minimize stress that would likely reduce the overall quality of the fish and potential for successful stocking. The figure was based on 12,000 production fish at the Gavins Point NFH annually, which will decrease over time as additional future captive broodstock will occupy this rearing space, thus reducing production capabilities for stocking.

The recovery priority management areas, referred to in Figure 8, are from the Pallid Sturgeon Recovery Plan and are as follows.

1. The Missouri River from the confluence of the Marias River to the headwaters of the Ft. Peck Reservoir;
2. The Missouri River from Ft. Peck Dam to the headwaters of Lake Sakakawea, including 71 miles of the Yellowstone River;

3. The Missouri River from Fort Randall Dam to the headwaters of Lewis and Clark Lake; and
4. The Missouri River from Gavins Point Dam to the confluence of the Missouri with the Mississippi River.

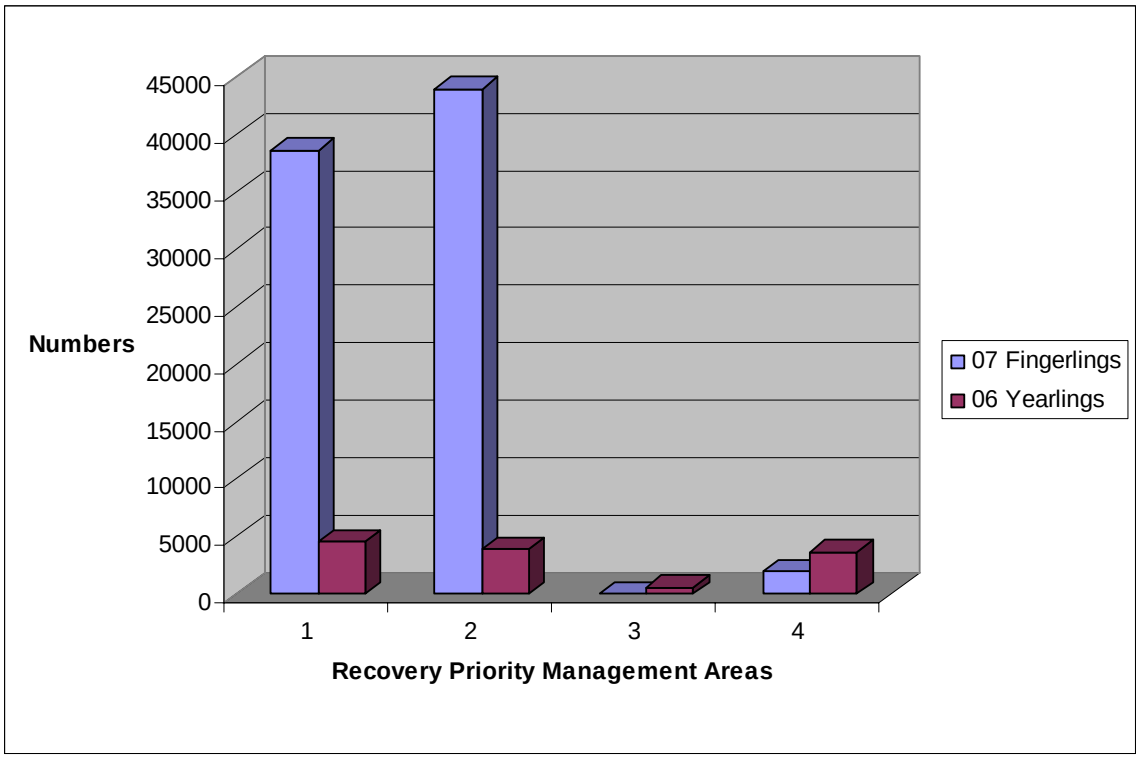


Figure 8. Stocking for the 2006 Yearlings and 2007 Fingerlings in 2007

IV.B.2.a. Fish Marking

A variety of marking methods have been utilized to identify hatchery fish which enhances scientists' understanding of the species (i.e., growth, movement, survival). The Passive Integrated Transponder (PIT) tag provides the maximum amount of information specific to individual fish. Smaller fingerlings (that cannot be PIT tagged based on size) are marked with tags such as an elastomer tag (visual) or a coded wire tag. These tags provide less information but, at a minimum, differentiate between hatchery and wild fish. Genetic analysis is utilized to differentiate between naturally reproduced and hatchery reared and stocked pallid sturgeon. The use of scute removal was also incorporated into the mix of marking types in 2007. Scute removal is a permanent mark and may be used to quantify PIT tag retention and serve as a secondary mark in conjunction with other marking techniques.

IV.B.2.b. Garrison Dam National Fish Hatchery (Riverdale, North Dakota)

The Garrison Dam NFH successfully spawned 7 females and 15 males, producing 33 families. Of these 33 families, 18 families were included as production fish, 14 for cryopreservation research, and 1 family for field evaluation of larval drift characteristics of pallid sturgeon and for fish feed trials at the Bozeman FTC. Spawning efforts of these fish ranged from May 24, 2007, through June 29, 2007, and yielded 967,300 eggs. Luteinizing Hormone-Releasing Hormone analogue (LH-RHa) was utilized to induce ovulation and spermiation in female (.05 milligrams [mg]/kilograms [kg] of body weight) and male (.02 mg/kg of body weight) pallid sturgeon. Egg hatch rates were excellent at 91 percent, including cryopreserved milt which was utilized to maintain genetic crosses at a 3 to 1 male to female ratio. Milt from 22 males was added to the cryopreservation repository for a total of 87 on station. In addition to the eggs spawned on station, 263,125 eggs were received

from the Gavins Point NFH, and another 35,595 eggs were received from the Miles City SFH for production purposes and to ensure these families were held at multiple locations serving as a backup.

A series of fish feeds were fed including Otohime B-1, B-2, C-1, C-2, S-2, Silver Cup #2 Salmon, Bio-Vita, and Cyclo-peeze.

The Garrison Dam NFH's water supply is the Missouri River (Lake Sakakawea), and water temperature ranged from 10.6 degrees Celsius (˚C) to 18.3˚C, with the coldest temperature in March and the warmest temperature in August. The water is filtered to 40 microns and treated via ultraviolet disinfection exceeding 100,000 microwattsec/centimeter $(cm)^2$. The water is also heated to provide temperatures suitable for successful spawning and rearing of pallid sturgeon.

The facility underwent routine fish health testing, and the results were negative for iridovirus for the third consecutive year.

The Garrison Dam NFH stocked 4,534 yearling and 3,317 fingerling pallid sturgeon in the Missouri River above Fort Peck Reservoir. Below Fort Peck Dam, including the Yellowstone River, 3,907 yearling and 38,949 fingerling pallid sturgeon were stocked. The facility also stocked out 454,606 fry (less than 14 days of age) into the Missouri River below Fort Peck Dam. In addition to the stocked fish, 1,545 fish representing 20 family lots were transported to Gavins Point NFH for inclusion into the future captive broodstock. The facility is also overwintering 8,400 fish from the 2007 year class for stocking in spring 2008 as yearlings.

IV.B.2.c. Miles City State Fish Hatchery (Miles City, Montana)

The Miles City SFH and Bozeman FTC worked cooperatively and spawned a female on June 1, 2007, and another female on June 20, 2007. The eggs from each female were crossed with three males, producing a collective total of six families (two females, six males). A total of 312,320 eggs were collected as a result of the onsite spawning efforts. LH-RHa was utilized to induce ovulation and spermiation in female (.05 mg/kg of body weight) and male (.02 mg/kg of body weight) pallid sturgeon.

The facility also received an additional 32,750 eggs from the successful spawning efforts at the Garrison Dam NFH. Egg hatch rate was 75 percent. In addition to the eggs retrained on station, the Miles City SFH shipped eggs to the Garrison Dam NFH and the Bozeman FTC for production and research needs. Milt from three of the six males spawned onsite was incorporated into the cryopreserved stock at the Garrison Dam NFH.

The Miles City SFH underwent two fish health inspections and tested negative on both occasions for iridovirus.

Fish feeds used for pallid sturgeon included Otohime B-1 and B-2 and Silver Cup #1 and #2.

The primary water source for the hatchery is pumped from the Yellowstone River. All Yellowstone River water used for pallid culture is filtered to 21 microns through rotating drum filters and ultraviolet disinfected to protect the fish from potential parasite and/or disease infestations. Depending on the time of year, the water may be heated (boiler) or cooled through a chiller to provide optimum temperatures for spawning and rearing pallid sturgeon. The hatchery has a small well which provides the ability to moderate water temperatures during the summer months when the Yellowstone River temperatures exceed the temperature range of rearing pallid sturgeon.

A large chiller was incorporated into the infrastructure of the Miles City SFH in 2004. Due to the large size of this unit, the existing backup generator is not adequate to run the chiller in the event of a power outage. In 2007, a smaller, portable chiller unit was installed to provide moderated water temperatures. This unit has been tested and is supplied with power from the backup generator during outages. Although this unit does not provide the quantities of water needed to meet the facilities' production needs, it does provide stable water temperatures to the critical life stages (eggs and fry) where temperature spikes have caused mortality in the past. The new chiller has been an essential addition to the Miles City SFH to enable the staff to reliably raise pallid sturgeon.

The facility stocked 13,125 fry in the Yellowstone River near Miles City in mid-July 2007. An additional 1,258 fingerlings were stocked in the Yellowstone River, and 1,258 fingerlings were stocked in the Missouri River downstream of Fort Peck Dam. Also 23,456 fingerlings were stocked above Fort Peck Dam and reservoir at multiple stocking locations within this recovery management unit.

The facility is holding over 5,000 fingerlings for advanced rearing and stocking in spring 2008.

IV.B.2.d. Bozeman Fish Technology Center (Bozeman, Montana)

In fall 2006, the facility tested positive for the iridovirus in the 2006 year class. As a result, all of these fish were euthanized, and the facility was disinfected to prepare for the 2007 year class.

Broodstock collection efforts in Recovery Priority Management Area 1 (above Fort Peck Reservoir) were unsuccessful in 2007; therefore, the Bozeman FTC did not conduct spawning at the facility or streamside, as has been done in the past. The Bozeman FTC did assist with spawning activities at the Miles City SFH.

The Bozeman FTC received approximately 65,000 eggs, representative of 10 families from the successful spawning efforts at the Miles City SFH and the Garrison Dam NFH. Eight of these family crosses were used for production purposes to achieve stocking targets, and two families were incorporated into research to improve fish survival, performance, and quality.

A variety of fish feeds were utilized at the facility, including Otohime, Cyclo-peeze, and Silver Cup.

The Bozeman FTC's water sources include a cold spring (8˚C), a warm spring (22˚C), and a warm well (22˚C). Water temperatures within the rearing tanks ranged from 16˚C to 19˚C. These water sources were mixed to provide the desired temperatures for rearing pallid sturgeon. Water treatments include bio-filters, sand filters, ultraviolet disinfection at 100,000 mwattsec/cm^2, and packed columns.

The Bozeman FTC stocked 12,995 fingerlings from the 2007 year class in the Missouri River above Fort Peck Reservoir.

In addition to rearing pallid sturgeon for the PPAP, two research projects were conducted with pallid sturgeon during FY 2007 and are summarized below.

1. Pallid Sturgeon culture to evaluate diets to improve fish survival, performance and quality: This evaluation was on newly hatched fry (2 days post hatch) and was conducted for a 60-day trial period. The purpose of this trial was to evaluate a variety of diets during early development to improve survival rates. Data from this experiment is presently being evaluated. However, we used preliminary data to make a recommendation of the use of Otohime diet with freeze-dried Cyclopeeze for starting fry. Dissemination of information included a presentation at a Miles City meeting on November 27-29, 2007, and will include a journal publication.

2. Evaluation of environmental and nutritional factors affecting skeletal mineralization in pallid sturgeon: This evaluation was on newly hatched fry and was conducted for a 120-day trial period. The purpose of this trial was to evaluate the effects of high nitrogen gas associated with fin curl severity. Data are still being analyzed from this project.

IV.B.2.e. Gavins Point National Fish Hatchery (Yankton, South Dakota)

On June 20, 2007, 4 female pallid sturgeon originating from the upper basin were spawned and crossed with 10 males, resulting in 12 families. Eight of the ten males used to make these crosses were from the captive broodstock held at the facility and are representatives of the 1997 year class. This is the first time captive broodstock have been utilized successfully to create viable progeny. Collectively, nearly 500,000 eggs were collected during the spawning effort. A portion of all 12 crosses were transferred to the Garrison Dam NFH for production purposes and to back up the genetic families at multiple locations to safeguard against catastrophic loss. A portion of the eggs collected at the Gavins Point NFH were shipped to the Garrison Dam NFH for

production purposes. The facility also received 30,123 eggs from the Garrison Dam NFH, representing seven families, for production and for incorporation into the future captive broodstock.

In addition to the upper basin broodstock spawning effort, a 13-pound female that was captured in the lower Missouri River (above the Platte River) earlier in the spring was successfully spawned on May 30, 2007. This female was crossed with two males and yielded 42,300 eggs. Seven additional males were on station but were unusable. The Gavins Point crew, along with the assistance of Gary Heidrich and Bruce Drecktrah of the Blind Pony SFH (Missouri Department of Conservation [MDC]), conducted the spawning efforts. These eggs were retained at the Gavins Point NFH for stocking efforts back into the lower Missouri River.

Collectively 14 families were produced, 12 from upper Missouri River basin adults and 2 from lower Missouri River basin. LH-RHa was used to induce ovulation in the females (10 mg/kg of body weight) and spermiation in the males (.01 mg/kg of body weight).

Overall, egg hatch was low, ranging from 20 to 50 percent.

A variety of fish feeds were utilized, including Silver Cup Salmon, Gemma, and Cyclo-peeze, in addition to rainbow trout for the captive broodstock and wild broodstock held on station for spawning purposes.

Water sources for the hatchery include three cold water wells and surface water from the Missouri River. The well water is untreated; however, the Missouri River water is filtered through rotating drum filters and treated with ultraviolet disinfection at a rate of 100,000 mwattsec/cm^2. Water temperature in the tanks ranged from 10 to 20.6˚C.

The facility tested negative for the iridovirus; however, fish health testing resulted in unknown suspect cells with necrosis in the intestines. Due to these results, 3,700 fall fingerlings were euthanized. A portion of these fish will be retained on station and are undergoing additional fish health evaluations in attempts to identify the organism or the cause of the cell abnormalities. The results of this continued fish health monitoring will determine whether or these fish will be utilized in the augmentation effort.

The facility stocked 600 yearlings in the Missouri River below Fort Randall Dam and 3,642 yearling downstream of Gavins Point Dam. The Gavins Point NFH was relatively successful rearing their lower Missouri River origin pallid sturgeon, and these fish will be stocked in spring 2008.

An additional 14 tanks were purchased and will be installed in the endangered species building, in place of the 2 large circular tanks previously utilized for holding wild broodstock captured from the river. The two large circular tanks will be moved into the Advanced Rearing and Future Captive Broodstock Building. This will isolate spawning activities and wild fish from production fish, thus minimizing the parasite and disease risks associated with bringing in wild fish for spawning.

IV.B.2.f. Neosho National Fish Hatchery (Neosho, Missouri)

One female and one male were successfully spawned at the Neosho NFH, producing a single family yielding approximately 30,000 eggs. This marked the first time that pallid sturgeon had been spawned at the Neosho NFH. Gary Heidrich and Bruce Drecktra of the MDC's Blind Pony SFH teamed up with the Neosho NFH crew to conduct the spawning effort at the Neosho NFH due to their previous experience and expertise in spawning sturgeon. LH-RHa was administered to induce ovulation in the females (.1mg/kg of body weight) and spermiation in the males (.10 mg/kg of body weight). Egg hatch rate was approximately 80 percent.

Hatched brine shrimp, adult brine shrimp, and bloodworms were utilized rather than commercial fish feeds.

Although spawning was successful, a rain event facilitated a high silt load at the Neosho NFH and decimated the newly hatched fry. The Garrison Dam NFH was able to provide 54,357 upper Missouri River basin fry to the Neosho NFH. These fish will be reared until 2008 and stocked out as yearlings in the lower Missouri River.

Neosho received pallid sturgeon fry (upper basin origin) from the Garrison Dam NFH, targeting stocking and augmentation in the lower Missouri River (i.e., below Gavins Point Dam).

The Neosho NFH is supplied with water from a spring and well. A portion of the water is heated to provide suitable rearing temperatures for pallid sturgeon. Also, a portion of the water is re-circulated to maximize the use of the heated water. All re-circulated water is also ultraviolet disinfected to minimize the potential for disease and parasite transmission between tanks.

The facility did not stock fish in 2007, but it will continue to rear the current year class (i.e., 2007) and stock them in 2008 in the lower Missouri River basin as yearlings.

The facility expansion was completed with all electrical and water supply infrastructure in place. This new building quadruples the production capacity of the facility from its previous capability. The facility now has the capability to rear nearly 20,000 yearling-sized pallid sturgeon.

On October 18, 2007, a total of 2001 pallid sturgeon, averaging 3.1 inches, were stocked in the Missouri River between Gavins Point Dam and the Platte River. These fish were progeny from upper basin stocks resulting from 2007 spawning efforts. The Neosho NFH is overwintering approximately 4,000 of these fish and will stock them out as yearlings in 2008.

IV.B.2.g. Blind Pony State Fish Hatchery (Sweet Springs, Missouri)

The Blind Pony SFH did not spawn or rear any pallid sturgeon at the facility in 2007 due to inadequate water levels in Blind Pony Lake. The lake has since filled to a level enabling fish culture; therefore, the Blind Pony SFH will be on line to spawn and rear pallid sturgeon in 2008. In 2007, the staff was actively involved in the propagation effort. The crew made multiple trips to transport nine wild broodstock from the river to the Neosho NFH. The Blind Pony staff also assisted with spawning efforts at the Gavins Point NFH and oversaw the spawning effort at the Neosho NFH.

Blind Pony SFH purchased fish feed to assist the Neosho NFH with meeting their fish feed needs for pallid sturgeon production.

IV.B.3. Research Program

The 2007 Research Program worked to develop a process that provides focus, independence, and scientific rigor to the research work funded through the Corps. The first step within that effort was to work with the Upper Basin Pallid Sturgeon Recovery Team Workgroup to further research activities within that geographic reach. The Corps worked with the workgroup and the Upper Basin's primary funding entity, Western Area Power Administration, to expand their program for 2007. Together, the Corps and Western Area Power Administration were able to fund over $500,000 worth of pertinent research to further our understanding of pallid sturgeon life history, physiology, and ecology. Projects funded by the Corps in the Upper Basin were:

1. Development of Management Tools for the Pallid Sturgeon Iridovirus – 2-year study;
2. Vulnerability of Age-0 Pallid Sturgeon to Fish Predation – 3-year study;
3. Fishing for Cytokines and Immune Molecules to Better Understand Pallid Sturgeon Health; and
4. Quantification of Pallid Sturgeon and Shovelnose Sturgeon Trophic Position in the Upper Missouri River – 3-year study.

Results for these reports are scheduled for 2008 and beyond.

IV.B.3.a. Comprehensive Sturgeon Research Project (CSRP)

The CSRP of 2007 was a combination of the two projects from 2006: CSRP and Spring Rise Flow Modification (SRFM). Most of the tasks funded in 2006 under CSRP were continued, and some of the more important elements of the SRFM project rounded out the effort. There was an addition of an independent scientific review of the entire CSRP project and its components. This activity is scheduled to take place in January 2008. Results of this review will be used to inform 2008 research decisions and activities. Specific elements of the CSRP for 2007 are summarized below and a more detailed description is provided following.

Task 1: Document movement, habitat use, and reproductive behavior of shovelnose and pallid sturgeon in the Missouri River;
Task 2: Describe the reproductive physiology of pallid sturgeon and shovelnose sturgeon prior to and after successful and unsuccessful spawning;
Task 3: Determine the habitat characteristics used by sturgeon for spawning, quantity of spawning habitat available (Availability and Change at the Patch Scale), and dynamics of habitat change related to varying discharge, sediment transport, and water quality;
Task 4: Spawning of pallid sturgeon and shovelnose sturgeon: site-specific assessment of spawning activity, habitat use, and larval fish distribution; and
Task 6: Information management and outreach.

Task 1: Document Movement, Habitat Use and Reproductive Behavior of Shovelnose and Pallid Sturgeon in the Missouri River

Data from this task provided preliminary feedback in 2005 and 2006. The question was if sturgeon migrate in one long migration or two short migrations (i.e. movement up to wintering grounds, overwinter, and move up again in spring). The pallid and shovelnose sturgeon both utilize the one migration strategy, beginning the trip early in the spring and spawning. In 2006, we furthered our understanding of the migration patterns and found that gravid pallid sturgeon do use the stretch of the Missouri River above the Platte River. Also in 2006, we learned that shovelnose sturgeon are spawning both above and below the Platte River.

In 2007, capture and implantation of pallid and shovelnose sturgeon was completed in late April. A total of eight adult pallid sturgeon were implanted. Five of the pallid sturgeon were in reproductive condition (three males and two females). This was the maximum number allowed by the Middle Basin workgroup. The reproductive pallid sturgeon were intensively tracked by the Nebraska Game and Parks Commission (NGPC). Tracking began in April. In addition to the 8 pallid sturgeon tagged for telemetry studies, 78 additional pallid sturgeon were captured and released. One large female (greater than 6 kg) was transported to Gavins Point NFH for propagation. The fish subsequently spawned and produced 40,000 eggs.

Both female pallid sturgeon implanted with transmitters were tracked extensively and recovered in late May. Both fish had released their eggs completely. One fish released eggs above Ponca, Nebraska, in the MNRR reach, and the other in the channelized river below Sioux City, Iowa.

Task 2: Describe the Reproductive Physiology of Pallid Sturgeon and Shovelnose Sturgeon Prior To and After Successful and Unsuccessful Spawning

a. Develop tools and assays to measure and analyze specific shovelnose and pallid reproductive hormones important in migration, gamete maturation, and release.

The effort to create the GthII peptide was unsuccessful, as the peptide we used was not suitable. It was determined that the USGS lab would have to make its own protein for the development of the antibodies. That process is underway.

b. Define environmental variables important to spawning: evaluate shovelnose and pallid pre-spawning and post-spawning reproductive condition coincident with local environmental conditions. Describe the relationship between reproductive condition of mature Scaphirhynchus and the phases of the 2007 hydrograph.

Samples of eggs and blood from fish captured by the USFWS (Columbia Offices), South Dakota Department of Game, Fish and Parks (SDGFP), and crews on the Wabash River are being processed. Graphs of polarization indexes were made and distributed weekly. Assistance was provided to the Neosho NFH in identifying reproductive readiness of their pallid sturgeon using polarization indexes and blood chemistry.

Task 3: Determine the Habitat Characteristics Used by Sturgeon for Spawning, Quantity of Spawning Habitat Available (Availability and Change at the Patch Scale), and Dynamics of Habitat Change Related to Varying Discharge, Sediment Transport, and Water Quality

a. Habitat Use: The USGS mapped 20 randomly selected sturgeon locations and 10 targeted spawning locations. Targeted reaches were identified by daily analysis of sturgeon locations and basing map reaches on plateaus of upstream movement. In addition to normal hydroacoustic maps, the side-scan sonar provides high-resolution visual images of the riverbed at the sites and might, in some cases, image aggregations of fish or individuals.

b. Habitat Availability: The USGS completed two surveys of habitat-availability, monitoring cross sections at the four sites: Yankton, Kensler's Bend, Little Sioux, and Miami reaches. Completion of the two-dimensional hydrodynamic model at Yankton is expected in early 2008. Ground-based Light Detection and Ranging (LiDAR) data was acquired at Yankton during low-flow conditions. The LiDAR dataset is being incorporated into the two-dimensional hydrodynamic model. The ground-based LiDAR dataset will be evaluated and compared to other existing datasets that include aerial LiDAR, Global Positioning System (GPS) surveys, and bathymetric surveys. If the ground-based LiDAR technology works, the need for traditional GPS surveys could be diminished, thereby reducing labor costs. The USGS completed preliminary two-dimensional hydrodynamic models at Kensler's Bend and Little Sioux; and they are working on additional calibration, validation, and sensitivity. Models should be completed in late 2007.

Task 4: Spawning of Pallid Sturgeon and Shovelnose Sturgeon: Site-Specific Assessment of Spawning Activity, Habitat Use, and Larval Fish Distribution

Efforts have been directed toward collecting larval fish samples from the Lower Missouri River, approximately between RM 590 and 811 (including five major tributaries: Platte River, Little Sioux River, Big Sioux River, Vermillion River, and James River), and sorting larvae in samples from debris. Currently three crews are sampling each of approximately 30 sites twice per week for the presence of sturgeon and other larvae. Water temperature loggers were deployed at various locations associated with sample sites in the Missouri River and each tributary. Furthermore, infrastructure (temporary office space, office supplies, etc.) were established in Yankton to support field crews from all collaborating agencies (USGS-Columbia Environmental Research Center, SDGFP, and USGS-NPWRC).

Task 6: Information Management and Outreach

The annual report (for the CSRP and SRFM), completed in December 2006, was peer reviewed and published in October 2007 and is available on the web at the address: http://pubs.usgs.gov/of/2007/1262/. The conceptual model for pallid life history was developed, and the paper was peer reviewed by the steering committee of the pallid sturgeon workshop. The manuscript has been published by the USGS publishing network.

IV.B.3.b. Pallid Sturgeon Workshop

The research program also put together a workshop for the pallid sturgeon. On July 31-August 2, 2007, in St. Louis, Missouri, the Pallid Sturgeon Program held a workshop titled, "Research Needs and Management Strategies for Pallid Sturgeon Recovery Workshop." The purpose and goals of the workshop were:

Purpose: "Provide technical guidance on a prioritized research and management strategy to assist range-wide pallid sturgeon recovery by engaging experts to review existing information, identify data gaps, prioritize research needs, propose an effective science process to get answers, and identify agencies whose authorities may be applicable in these efforts."

Goals: Develop technical guidance on a research strategy to assist range-wide pallid sturgeon recovery. In this context, each basin will have specific and prioritized research needs based on current understandings within the basin and identified data gaps.

Develop technical guidance on a recovery strategy to assist range-wide pallid sturgeon recovery. Where applicable, each basin will have specific and prioritized restoration needs based on current data within the basin supporting those restoration efforts.

There were 59 invited experts were at the workshop, including 6 experts from outside the basin and 53 experts from within the basin. Of the 59, 35 were with Federal agencies, 13 with State agencies, and 11 from universities. There were 28 observers.

Invited experts and observers reviewed the current pallid sturgeon life-history model and made recommendations for modifications to the model and developed lists of priority research needs within each sub-basin. The highest priority research needs identified were discussed. A detailed report is being prepared and should be available by April 2008.

IV.B.4. Habitat Assessment Monitoring Program

The Pallid Sturgeon Habitat Assessment and Monitoring Program (HAMP) began in 2004 and has been developed by the HAMP Team. The HAMP Team is comprised of representatives of State and Federal agencies and academia that collectively possess responsibility, knowledge and expertise of the Missouri River, pallid sturgeon and native Missouri River fishes, research, experimental design, and statistical analysis. The HAMP Team includes the MDC, University of Missouri, USGS, USFWS, Iowa Department of Natural Resources, NGPC, SDGFP, Corps and others.

The program focuses on the endangered pallid sturgeon and a series of native Missouri River species and their habitats as required in the BiOp and the 2003 Amendment.

IV.B.4.a. Objectives of the Project

The goal of HAMP is to assess the physical and biological responses to habitat creation actions which are expected to benefit pallid sturgeon and related communities. The research questions this document will address are as follows:

1. Assess and monitor the physical changes between control bends and modified bends:
    a. There is no physical difference between the constructed sites and the controls site.
    b. The constructed habitat sites have more physical value than the control sites.
2. Assess and monitor pallid sturgeon response and other biological changes between control bends and modified bends:
    a. There are no differences in native target species (i.e., young-of-year [YOY] and juvenile pallid sturgeon, YOY and juvenile shovelnose sturgeon, sicklefin chubs, sturgeon chubs, speckled chubs, plains and western silvery minnow, YOY and juvenile blue sucker and sauger) relative to species composition, richness, and relative abundance between the constructed sites and the control sites.
    b. Native target species (i.e., YOY and juvenile pallid sturgeon, YOY and juvenile shovelnose sturgeon, sicklefin chubs, sturgeon chubs, speckled chubs, plains and western silvery minnow, YOY and juvenile blue sucker and sauger) composition, richness, and relative abundance are greater at the constructed sites than at the control sites.

IV.B.4.b. Project Status Update

Study bends sampled by the USFWS and NGPC were finalized for the program in early 2007 and include the bends listed in Tables 3 and 4. In the stretch between Sioux City, Iowa, and Rulo, Nebraska, the NGPC sampled 20 bends every 4 to 6 weeks from April through October. All bends were sampled with all standard gears in a series of rounds (repeat visits on a 4 to 6 week schedule), with the exception of the 16-foot 4-millimeter (mm) Otter Trawl effort not being completed in July due to a boat malfunction. In the reach from Rulo, Nebraska, to the mouth, the USFWS, Columbia Fishery Resource Office, sampled 18 bends in a series of rounds from June through October. High water conditions in late May and early October created conditions unsuitable (relative to safety) for sampling; therefore, sampling was limited during these periods of high water.

Table 3. Study Bends Sampled by Segment by Nebraska Game and Parks Commission Staff

Segment 8 (Ponca, Nebraska to Platte River)			
Bend Name	**US River Mile**	**Treatment Type**	**% Bend Radius**
Glovers Point Upper	714.3	B/A	75
Decatur Lower	687.4	B/A	25
Louisville Upper	686.0	B/A	25
Little Sioux Reach Upper	676.3	B/A	75
Little Sioux Reach Lower	672.8	Treatment	25
Peterson Cut-off Lower	659.2	Control	75
Tysons	655.0	Treatment	75
DeSoto Cut-off	644.8	Treatment	75
Calhoun Lower	638.5	Control	25
Boyer Lower	636.0	Treatment	25
Segment 9 (Specifically Platte River to Rulo, Nebraska)			
Bend Name	**US River Mile**	**Treatment**	**% Bend Radius**
Tobacco	589.4	Treatment	75
Pin Hook	579.2	Treatment	25
Van Horns	576.8	Control	75
Civil Upper	574.8	B/A	75
Civil Lower A	572.8	B/A	25
Copeland Lower	565.1	B/A	75
Nebraska	562.9	Treatment	75
Otoe	556.7	B/A	25
Hamburg Upper	555.5	Treatment	25
Barney Upper	550.9	Control	25

All bends sampled for the physical component sampling in the Omaha and Kansas City Districts were completed for 2007 between July and September. Data collected for 2007 will be processed by December 2007.

During 2007, minor changes were incorporated to the project's design to address the changes in the project's objectives. The original focus was to be able to detect trends of a wide range of life history stages of pallid sturgeon and associated fish species. Because habitat modifications are to create SWH, which provide nursery and refuge habitat for pallid sturgeon, the focus of a wide range of life history stages was altered to focus on small bodied fishes (i.e., YOY and juvenile pallid sturgeon, shovelnose sturgeon and blue sucker, and associated native target fishes). Subsequent to the change in the focus for the project and as suggested by the independent scientific review panel, a reduction of gear was established and three standard gears were selected for the project. These gears include trawling gears (i.e., 16-foot. otter trawl, 16-foot 4-mm mesh otter trawl, and an 8-foot 4-mm push trawl) designed to collect small bodied fishes. The project also implemented sampling all study bends within a 6-week sampling period with each standard trawling gear. Sampling all study bends in 6-week sampling periods between the two offices will allow characterization of annual and inter-annual variation of fish metrics.

A contracted staff person was also hired in 2007 to assist with coordinating meetings, developing a guiding document/standard operating procedures, conduct quality assurance for field crews, and develop a standardized reporting template for the project. The guiding document will include a background of the project and also standard operating procedures. This document will ensure collection and recording of data will be consistent for the project. This document will be fully implemented for the 2008 sampling season. The annual reporting template will ensure that both agencies of the biological component are assimilating information similarly. For instance, all graphs and tables will be standardized between segments using the same analyses. Any additional extra sampling or analyses will be included within the appendices of the annul reports of each office collecting biological data. The standardization of the annual report document will allow for comparisons between segments and will implemented for 2007 annual reporting.

Table 4. Study Bends Sampled by Segment by Columbia Fishery Resource Office Staff

Segment 10 (Grand River to Kansas River)			
Bend Name	**US River Mile**	**Treatment**	**% Bend Radius**
Lower Miami	260.2	Treatment	25
Malta	274.0	B/A	25
Baltimore	304.4	B/A	75
Sni	321.1	Control	75
Camden	327.1	Control	25
Fishing River	335.3	Treatment	75
Segment 13 (Osage River to Grand River)			
Bend Name	**US River Mile**	**Treatment**	**% Bend Radius**
Eureka Bend	162.4	Treatment	25
Searcy's Bend	180.5	B/A	25
Rocheport Bend	183.5	Treatment	75
Slaughterhouse Bend	205.6	Control	75
Robinson Bends	209.3	B/A	75
Wilhoite Bend	234.5	Control	25
Segment 14 (Confluence with the Mississippi River to Osage River)			
Bend Name	**US River Mile**	**Treatment Type**	**% Bend Radius**
Creve Coeur	31.8	B/A	75
Doziers Bend	48.6	Treatment	75
Washington Bend	69.8	Control	75
Pinckney Bend	85.5	Control	25
Chamois Bend	119.1	B/A	25
Isbell Bends	127.3	Treatment	25

One of the major goals of the project is to have the capability to incorporate the physical habitat data with the biological data. Two collaborative teams, one for the Omaha reach and one for the Kansas City reach, consisting of biologists, engineers, and geomorphologists within in the project, were formed to guide the efforts of integrating the biological and physical data. A parent team, which consists of a subset of both teams, was also selected to ensure the integration and assimilation of information from these analyses is completed in a consistent manner. Integration of these data will assist in answering questions about habitat use and will be used as a tool to inform the physical component about fish use of newly created habitat by target fish species and what habitat conditions fishes are using to better improve habitat quality.

IV.B.4.c. Summary Reports

The reports for each segment (i.e. Rulo, Nebraska, and above and Rulo, Nebraska, and below), the independent scientific reviews, and any analyses will be available on the web at www.moriverrecovery.org, listed under "Publications and Reports," which is under development.

IV.B.5. Fort Peck Biological Monitoring (submitted by the State of Montana)

The BiOp developed by the USFWS formally identified that seasonally atypical discharge and water temperature regimes resulting from operations of Fort Peck Dam have precluded successful spawning and recruitment of pallid sturgeon in the Missouri River below Fort Peck Dam. In response, the Corps proposes to study modifications to operations at Fort Peck Dam and other options to enhance environmental conditions for spawning and recruitment of pallid sturgeon. Modified dam operations include releasing warm surface water over the Fort Peck Dam spillway. The Fort Peck Flow Modification Biological Data Collection Plan (hereafter Fort Peck Data Collection Plan) was initiated in 2001 to evaluate the influence of proposed flow and

temperature modifications on physical habitat and biological response of pallid sturgeon and other native fishes. Research and monitoring activities have been conducted annually since 2001.

During 2007, the Corps supported the Fort Peck Data Collection Plan to include the following activities:

1. Measure water temperature and turbidity at several locations in the Missouri River downstream from Fort Peck Dam and in off-channel and tributary locations;
2. Implant adult pallid sturgeon, paddlefish (*Polyodon spathula*), blue suckers, and shovelnose sturgeon with radio transmitters; examine movements; and relocate these species in the Yellowstone River and Missouri River between Fort Peck Dam and Lake Sakakawea;
3. Quantify larval fish distribution and abundance in the Missouri River below Fort Peck Dam, selected tributaries, and off-channel areas;
4. Quantify the reproductive success of shovelnose sturgeon and pallid sturgeon based on captures of YOY sturgeon;
5. Conduct a larval pallid sturgeon drift test in the mainstem Missouri River below Fort Peck Dam; and
6. Assist in the collection of adult pallid sturgeon for the propagation program.

Activities associated with the Fort Peck Data Collection Plan were jointly implemented by the Montana Department of Fish, Wildlife, and Parks and the USGS - Columbia Environmental Research Center. Similar to 2001 through 2006, proposed flow modifications were not implemented in FY 2007 due to inadequate precipitation and insufficient water levels in Fort Peck Reservoir.

Research Component 1: Water temperature loggers were deployed from April through October 2007. Data compilation and analysis of the 2007 data is in progress. During FY 2007, analysis of water temperature data collected from April through October 2006 was completed. Mean daily water temperature was warmest in the free-flowing Missouri River upstream from Fort Peck Reservoir (Robinson Bridge, mean = 18.2^{o}C) and coolest at the site downstream from Fort Peck Dam (mean = 12.0^{o}C). Thus, hypolimnetic releases from the dam suppressed water temperature by an average of 6.2^{o}C during the common deployment period. However, maximum water temperature was suppressed 11.3^{o}C by hypolimnetic dam releases between the two sites. Water temperatures gradually increased from below Fort Peck Dam downstream to Nohly, Montana (most downstream Missouri River site prior to receiving inputs from the Yellowstone River). Although warming occurred, mean (16.7^{o}C) and maximum (24.5^{o}C) water temperatures at Nohly remained 1.5-2.4^{o}C cooler than in the Missouri River upstream from Fort Peck Reservoir. Thus, despite gradual attenuation of the effects of hypolimnetic releases, water temperature remained impacted 290 kilometers (km) downstream from the dam. Data from turbidity loggers deployed from April through August 2007 are being compiled and analyzed. However, analysis of turbidity data collected during 2006 was completed during FY 2007. Turbidity in the Missouri River increased from upstream to downstream sites, and was lowest at the site closest to Fort Peck Dam (i.e., Frazer Rapids), intermediate at Poplar, Montana, and highest at Nohly. Turbidity in the Yellowstone River tended to be slightly lower than in the Missouri River at Nohly. Temporally, periods of elevated turbidity occurred at all sites, and many periods of elevated turbidity were associated with changes in river discharge.

Research Component 2: Extensive radio tracking of the Missouri River from Fort Peck Dam to the headwaters of Lake Sakakawea and in the lower Yellowstone River was conducted between April and November 2007. These data are currently being compiled and analyzed. However, analysis of telemetry data collected during 2006 was completed in FY 2007. A total of 24 individual tracking events were conducted throughout the river systems. Totals of 1,022 relocations of shovelnose sturgeon, 995 relocations of blue suckers, 386 relocations of paddlefish, and 322 relocations of pallid sturgeon were obtained via boat. Seven continuous-recording telemetry-logging stations logged an additional 772 contacts of implanted fish. For shovelnose sturgeon, telemetry observations indicated that 40 to 50 percent of the implanted individuals exhibited limited movements and remained in the Missouri River between Fort Peck Dam and Wolf Point for much of the year. A second group of shovelnose sturgeon was highly mobile and migrated from the Missouri River below Wolf Point into the Yellowstone River between April and June, then initiated migrations out of the Yellowstone River during mid-July. Blue suckers were primarily relocated in the Missouri River during early May, initiated downstream Missouri River migrations and entry into the Yellowstone River in mid-May, then migrated out of the Yellowstone River and back into the Missouri River during early August. A few blue suckers (less than 10 percent of implanted individuals) also migrated into the Milk River between late April and early May, prior to migrating downstream in the Missouri River. Paddlefish were highly migratory, as about 40 percent and 60 percent of the implanted individuals migrated into the Missouri River and Yellowstone River, respectively.

Paddlefish remained in the Yellowstone River through mid-June and in the Missouri River through July. After July, about 90 percent of the implanted paddlefish were relocated in the Missouri River downstream from the Yellowstone River confluence. Pallid sturgeon initiated migrations primarily into the Yellowstone River by early April, and greater than 80 percent of implanted pallid sturgeon were present in the Yellowstone River through late-June. After June, pallid sturgeon migrated out of the Yellowstone River back to the Missouri River below the Yellowstone River confluence. About 20 percent of the implanted pallid sturgeon used the Missouri River upstream from the Yellowstone River confluence, and this proportion was relatively consistent between early April and September.

Research Component 3: Intensive larval fish sampling was conducted between late May and early August 2007. Larval fish samples from all sites (Missouri River below Fort Peck Dam [Wolf Point, Nohly]; Milk River; Yellowstone River; spillway channel) are currently being processed and enumerated. Larval fish information collected during 2006 was analyzed during FY 2007. A total of 2,044 larval fish samples were obtained between late May and early August. More than 3,700 larvae representative of eight families were sampled from mainstem Missouri River sites, the Milk River, Yellowstone River, and spillway channel. Representatives of Catostomidae (i.e., suckers) were numerically dominant and composed 60.5 percent of all larvae sampled. The Cyprinidae (i.e., carps and minnows) composed 23.2 percent of the larvae sampled. Representatives of Percidae (i.e., perches) and Hiodontidae (exclusively goldeye, *Hiodon alosoides*) composed 9.0 percent and 3.4 percent of the larvae sampled, respectively. A total of 17 Acipenseridae larvae (0.5 percent of the total) and 55 Polyodontidae larvae (exclusively paddlefish, 1.5 percent of the larvae) were identified; but 2 additional larvae (0.05 percent of the total) could not be confidently distinguished as *Scaphirhynchus sp*. or paddlefish. Thirteen acipenseriform eggs were sampled in addition to nearly 31,000 eggs from other species. Larval *Scaphirhynchus sp.* were sampled from the Yellowstone River and two sites (Wolf Point, Nohly) in the Missouri River.

Research Component 4: Reproductive success of shovelnose sturgeon and pallid sturgeon was assessed under research component 4 from mid-July through early September 2007. Similar to other research components, data from 2007 are being processed and analyzed. However, trawling data from 2006 was analyzed during 2007. A total of 359 trawls were conducted during 2006 on eight sampling events between July 19 and September 7. Trawls were partitioned among the Missouri River upstream from the Yellowstone River confluence (98 trawls), Missouri River below the Yellowstone River confluence (168 trawls), and Yellowstone River (93 trawls). Only 13 YOY sturgeon were sampled: one individual was sampled in the Missouri River upstream from the Yellowstone River confluence, and 12 individuals were sampled in the Missouri River downstream from the Yellowstone River confluence. No YOY sturgeon were sampled in the Yellowstone River. Genetic analysis of YOY sturgeon sampled during 2006 indicated that all fish were shovelnose sturgeon.

Research Component 5: A larval pallid sturgeon drift study was implemented during July 2007 to assess the drift dynamics of 5 day post-hatch (dph) larvae, 6 dph larvae, 10 dph larvae, 12 dph larvae, and 13 dph larvae in the mainstem Missouri River downstream from Fort Peck Dam. This study was an extension of larval drift studies conducted in a side channel during 2004, but it was directed towards assessing drift patterns and cumulative drift distance in the mainstem river, where drifting larvae were subjected to main channel habitats, diverse hydraulic conditions, and an extended drift reach (about 180 km). Data from this study are currently being processed and analyzed. However, initial results indicate that the youngest age classes of released larvae (5-6 dph) drifted at least 180 km following release. Additionally, the majority of larvae sampled were collected in nets fished on the bottom of the river.

Research Component 6: Assistance was provided during fall 2006 and spring 2007 to catch adult pallid sturgeon for the propagation and augmentation program. Adults captured were assessed by hatchery personnel and reproductive physiology experts to determine suitability for propagation.

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IV.C. Least Tern and Piping Plover Summary

IV.C.1. Reasonable and Prudent Alternatives Applicable to Specific Species – Least Tern and Piping Plover

The 2003 BiOp Amendment states that, "Habitat shall be provided as a priority and other management actions implemented to meet or exceed fledgling per pair ratio goals of 0.70 for least terns and 1.13 for piping plovers. These are to be determined as the recent (past) 3-year running average… These fledge ratios have been superceded (sic) by those found in the incidental take statement of this document." The incidental take statement fledge ratios that supersede the above fledge ratios are 0.94 for least terns and 1.22 for piping plovers.

The 3-year running average fledge ratio for least terns, 2005 through 2007, was 0.87 fledglings per adult pair (1,186 fledglings of 1,358 adult pairs). The 3-year running average fledge ratio for piping plovers, 2005 through 2007, was 0.89 fledglings per adult pair (1,933 fledglings per 2,163 adult pairs). The Corps did not meet the fledge-ratio goals for habitat for either species.

IV.C.2. Missouri River Least Terns

IV.C.2.a. Incidental Take

1. Take of Eggs and Chicks by Flooding on the River and Reservoir Reaches that Result from the Corps' Operations of the Water Control System

The 2003 BiOp Amendment states that, "Reinitiation of consultation will be required if the Corps' actions result in take of more than 180 eggs in a 3-year consecutive period." Table 5 shows the incidental take losses for the Missouri River for 2005 through 2007.

Table 5. Incidental Take – Least Terns, 2005-2007

Year	Eggs	Chicks	Total
2005	9	0	9
2006	12	2	14
2007	30	5	35
3-Year Total	**51**	**7**	**58**

The 3-year running total of 58 eggs and chicks for 2005 through 2007 was well below the 180 eggs (and chicks) trigger set forth in the 2003 BiOp Amendment.

2. Take of Eggs, Chicks, and Adults by Factors Influenced By, But Not Directly Attributable, to the Corps

The 2003 BiOp Amendment states that, "The Corps should reinitiate consultation if the running 5-year average fledge ratio is less than 0.94." In 2007, the 5-year running fledge ratio (2003 through 2007) was 0.89 fledglings per adult pair (1,853 fledglings per 2,090 adult pairs). The Corps did not meet this incidental take measure.

IV.C.2.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Least Terns, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2007, an adult census and productivity monitoring were conducted for least terns on the Missouri River. The adult census was 1,010. In 2007, 725 least tern nests and broods (705 nests and 20 broods) were found on the Missouri River. Of the 705 nests found, 444 nests were successful, for a nest success of 63.0 percent. In 2007,

379 least tern chicks fledged. The fledge ratio for 2007 was 0.75 fledglings per adult pair. Table 6 summarizes least tern adult census and productivity by segment in 2007.

Table 6. Adult Census and Productivity Monitoring of the Interior Population of Least Terns on the Missouri River 2007

Segment	Adult Census	Nests	Broods	Nests Hatched	% Nest Success (a)	Number of Eggs	Number of Chicks	Total Chicks Fledged	Fledge Ratio (b)
Segment 1 - Fort Peck Lake	2	1	0	1	100.0	2	1	0	0.00
Segment 2 - Fort Peck River	77	39	0	33	84.6	100	83	53	1.38
Segment 3 -Lake Sakakawea	53	40	0	24	60.0	85	51	19	0.72
Segment 4 - Garrison River	123	75	3	57	76.0	197	151	65	1.06
Segment 5 – Lake Oahe	186	142	4	55	38.7	313	139	45	0.48
Segment 7 -Lake Francis Case	0	1	0	0	0.0	2	0	0	0.00
Segment 8 - Fort Randall River	74	46	0	33	71.7	115	90	11	0.30
Segment 9 -Lewis and Clark Lake	85	90	3	53	58.9	221	136	67	1.58
Segment 10 - Gavins Point River	410	271	10	188	69.4	720	519	119	0.59
Total	**1,010**	**705**	**20**	**444**	**63.0**	**1,760**	**1,170**	**379**	**0.75**

(a) % Nest Success = (HN/N)*100, where HN= hatched nests and N=number of nests. Broods are not included in the nest success calculation.
(b) Fledge Ratio = number of fledged chicks per pair of adult birds

RPM 1.2 – Mortality

1.2.a – Nest Fates: In 2007, there were 705 least tern nests on the Missouri River. Of these nests, 444 were successful (at least one egg hatched from the nest). In addition to these successful nests, there were 20 least tern broods that were found that could not be associated with any previously known nest. (The nest was not found before the chicks hatched.) The nest success was 63.0 percent. For the 261 non-successful nests, the nest fates are as follows:

1. Flooded (Non-Corps Operations) – 2 nests: These nests were lost to rising river levels as a result of rain storms in the area.
2. Flooded (Corps Operations) – 12 nests: These nests were lost due to the Corps' operation of the Missouri River dams.
3. Weather (Non-Corps Operations) – 36 nests: These are nests were lost to weather events such as rain, hail, wind, and wave action.
4. Weather (Corps Operations) – 3 nests: These nests were lost to wave action as a result of Corps operations increasing releases out of Fort Randall Dam.
5. Predation – 43 nests: Predators include mink, raccoons, coyotes, owls, gulls, crows, and other mammal and avian species.
6. Livestock – 6 nests: These nests were destroyed by livestock stepping on them.
7. Bank erosion – 6 nests: These nests were lost due to the river eroding away nest sites.
8. Wildlife – 3 nests: These nests were destroyed by Canada geese stepping on the nests.
9. Human Disturbance – 2 nests: These nests were lost to human activity.
10. Destroyed, no evidence – 47 nests: These were nests that were destroyed before the eggs could have hatched, but for which no cause could be determined by the survey crew.

11) Abandoned – 29 nests: These are nests that were abandoned by the adults.
12. Non-Viable Eggs – 9 nests: These are nests in which the eggs were not viable but were still incubated by the adults.
13. Fate Undetermined – 63 nests: These are nests where the egg incubation was far enough along, that the eggs could have hatched between site visits. However, the crew could find neither evidence of egg hatching nor evidence that the nest had been destroyed prior to the subsequent nest visit.

1.2.b – Adult and Chick Mortality: Survey crews were instructed to try to determine a cause of death for least tern adults and chicks found on site. If a cause of death could not be determined, and the specimen was fresh (little to no decomposition), the specimen was then sent to the National Wildlife Health Center (NWHC) in Madison, Wisconsin, for analysis.

In 2007, the remains of six least tern adults, one fledgling, and seven chicks were found by survey crews. The specimens are listed by segment and date.

1. Fort Peck River Segment – 3 adults

July 11, 2007: One adult was collected off of a sandbar at RM 1609.0 and was sent to the NWHC for necropsy. The necropsy determined that the adult died from the West Nile virus.
July 17, 2007: Two adults were found on the same sandbar at RM 1609.0 as the adult above. The two were too decomposed to send for necropsy; but, due to the location and time of discovery, it is possible the two also died from the West Nile virus.

2. Lake Sakakawea Segment – 1 adult

July 11, 2007: One adult was found along the east shore of the Van Hook Arm. There were no obvious signs of a cause of death, and it was too decomposed to send for necropsy.

3. Garrison River Segment – 1 chick

July 31, 2007: One 7-day-old chick was found dead on a sandbar at RM 1358.0. The chick was too decomposed to determine a cause of death or to be sent in for necropsy.

4. Lake Oahe Segment – 1 chick

August 6, 2007: One 1- to 2-day-old chick was found dead on the shoreline south of Swiftbird Bay. The chick was too decomposed to determine a cause of death or to be sent in for necropsy.

5. Gavins Point River Segment – 2 adults, 1 fledgling, 5 chicks

July 2, 2007: One adult was found on a sandbar at RM 779.0. There were no obvious signs of a cause of death, and it was too decomposed to send for necropsy.
July 16, 2007: Two 1-day-old chicks were found on a sandbar at RM 779.0. The chicks may have died as a result of heavy rainstorms in the area.
July 16, 2007: Two 1-day-old chicks were found on a sandbar at RM 779.1. The chicks may have died as a result of heavy rainstorms in the area.
July 16, 2007: One 21-day-old fledgling was found on a sandbar at RM 779.1. The juvenile may have died as a result of heavy rainstorms in the area.
July 24, 2007: One adult was found on a sandbar at RM 779.1. There were no obvious signs of a cause of death and it was too decomposed to send for necropsy.
July 31, 2007: A 1-day-old chick was found near a nest bowl on a sandbar at RM 777.5. The specimen was sent to the NWHC for necropsy.

1.2.c – Measures Taken to Reduce Mortality: The Corps undertook several actions in 2007 to reduce mortality for least terns. These actions are discussed below.

1. Predator Trapping: During the 2007 nesting season, Corps monitoring personnel and researchers for the USGS and Virginia Polytechnic Institute noted losses of nests and chicks to predation on the Gavins Point river segment.

The Corps obtained a predator control permit from the State of Nebraska and a scientific collector's permit from the State of South Dakota and contracted with the U.S. Department of Agriculture (USDA) Wildlife Services to perform predator control work on selected sites within the segment. Live traps for Great Horned Owls (*Bubo virginianus*) were placed on created sandbars located at RMs 754.5, 755.0, 761.3, and 770.0 on the Gavins Point river segment of the Missouri River and at RM 826.5 on Lewis and Clark Lake segment. Live traps were also set on sandbars at RMs 782.5, 791.5, and 795.3 on the Gavins Point river

segment. These sandbars were being monitored as control sites for a least tern study being conducted by the USGS.

One modified pole trap and one modified goshawk trap were set on each of the eight sites on June 28-29 and July 9-10, 2007. The traps were disabled June 30 for approximately 1 week before being reset July 9 and retrieved July 11. Traps were set on high parts of the sites away from known least tern and piping plover nests. The traps were checked daily for owls and set offs.

Out of 64 trapping nights (8 modified pole traps for 4 nights and 8 goshawk traps for 4 nights), one adult Great Horned Owl was captured. The owl was captured by the modified pole trap during the night of June 29 on the sandbar at the RM 770 complex. The owl was retrieved by Ricky Woods and Scott Rosendahl, USDA Wildlife Services, and Jared Stirling, Corps, at 1000 hours on June 30. The owl was transported to the Pawnee State Recreation Area near Lincoln, Nebraska, by Mr. Woods, where it was banded and released.

The owl was the only bird captured during this trapping effort. Several traps were set off, and it is assumed that these were caused by high winds that occurred during the two trapping periods.

2. Nest Moving and Raising: To prevent the loss of least tern and piping plover nests to rising lake levels and increased releases from dams, nests were moved to higher locations, raised by building nest mounds, or, in three cases, both moved and raised. The results are shown in Table 7.

Table 7. Least Tern Nest Moving, Raising, Moving, and Raising 2007

Type	Nests	Successful	% Suc.	FL	BE	PR	AB	DU	NV
Moved	6	2	33.0	0	1	1	0	2	0
Raised	21	11	52.4	7	0	0	1	1	1
Moved & Raised	1	1	100.0	0	0	0	0	0	0
Total	**28**	**14**	**50.0**	**7**	**1**	**1**	**1**	**3**	**1**

Successful = at least one egg hatched, FL = flooded, PR = predation, BE = bank erosion, AB = abandoned, DU = destroyed, unknown cause, UN = undetermined fate, NV = non-viable eggs

The results show that, after the action, half of the nests were subsequently successful, and none of the nests were lost to flooding. The largest loss by cause was due to predation, and all of these nests were lost at one site, RM 835.0 on the Lewis and Clark Lake segment.

3. Chick Platforms: With the increase in releases out of Fort Randall and Gavins Point Dams in late July 2007 to support navigation in the lower river, it was determined that the sandbars at RM 842.8 in the Lewis and Clark Lake segment and at RM 807.2 on the Gavins Point river segment would likely be inundated. Both of these sandbars had unfledged least tern chicks. It was decided to construct chick platforms that would be higher than the river level after the increase in releases. The platforms were constructed by placing sand over tires anchored by rebar, with logs on the upriver side to deflect flows. Vegetation and driftwood were placed on the platforms to provide hiding places for the chicks.

Eight tern chicks were moved to the platform constructed at RM 807.2, and five chicks were moved to the platform constructed at RM 842.8. In addition to these two platforms, a nest containing a newly hatched least tern chick and one unhatched egg was raised, and the chick and egg were placed on the raised nest. The increased releases subsequently inundated the sandbars at RMs 842.7 and 807.2. Of the 14 chicks that were relocated to the two chick platforms and raised nest, 10 fledged: 5 from RM 842.8 and 5 from RM 807.2.

RPM 1.3 – Annual Reporting

The Corps did not meet the December 31 deadline as specified in this RPM.

RPM 2 – Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns

RPM 2.2 - Water Management Coordination

Throughout the nesting season, representatives of the Corps' Water Management Division, the Corps' Threatened and Endangered Species Section, and the USFWS held conference calls every Monday, Wednesday, and Friday to discuss water releases from the Missouri River dams and their effects on least terns. These calls were used to discuss impending changes to water release schedules relative to nests and sandbars that have been identified as "at risk" due to Corps operations, to assess risk, and to discuss alternatives to proposed actions. The calls provided timely information throughout the 2007 nesting season and helped to minimize incidental take by Corps operations. The Corps Water Management Division staff followed the steady release, flow-to-target operation identified in the 2006-2007 Annual Operating Plan. The results of this flow management will be described in the Missouri River Mainstem System Summary of Actual 2007 Regulation report (in press).

RPM 4 – Monitor, Evaluate, and Modify Created and Rehabilitated Sandbars

RPM 4.1 – Created Sandbars

The Corps constructed sandbar complexes on the Gavins Point river segment in 2004 at RM 755.0 and in 2005 at RMs 770.0 and 761.3. In fall 2006 and spring 2007, construction on a sandbar complex in the Lewis and Clark Lake segment at RM 826.0 was begun. Construction of this complex was not completed by the time least terns arrived in 2007, and work was halted until after the end of the nesting season.

Least terns used all four created sandbar complexes in 2007. Tables 8 and 9 show nest success on the created sandbars versus non-created sandbars on the Lewis and Clark Lake segment and the Gavins Point river segment.

Table 8. Least Tern Nest Success: Created Sandbars vs. Non-Created Sandbars Lewis and Clark Lake Segment 2007

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	70	47	9	14	67.1	75.3
Non-Created	23	9	13	1	32.9	24.7
Total	**93**	**56**	**22**	**15**	**60.2**	**100.0**

Table 9. Least Tern Nest Success: Created Sandbars vs. Non-Created Sandbars Gavins Point River Segment 2007

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	133	110	20	3	82.7	47.3
Non-Created	148	88	52	8	59.5	52.7
Total	**281**	**198**	**72**	**11**	**70.5**	**100.0**

The tables show that the created sandbars on both the Lewis and Clark Lake segment and the Gavins Point river segment had much higher nest success compared to the nests on the non-created sandbars of both segments. Tables 10 and 11 show the number of adults, percent of total adults, number of fledglings, percent of total fledglings, and fledge ratios for created versus non-created sandbars for the two segments.

Table 10. Least Tern Adults, Fledglings, and Fledge Ratios: Created Sandbars vs. Non-Created Sandbars – Lewis and Clark Lake Segment 2007

Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	52	61.2	56	83.6	2.15
Non-Created	33	38.8	11	16.4	0.67
Total	**85**	**100.0**	**67**	**100.0**	**1.58**

Table 10 shows that, on the Lewis and Clark Lake segment, the majority of the adults and fledglings were on the created sandbars. The created sandbars had a fledge ratio that was double the fledge-ratio goal of 0.94, while the fledge ratio for the non-created sandbars was below the 0.94 metric.

Table 11. Least Tern Adults, Fledglings, and Fledge Ratios: Created Sandbars vs. Non-Created Sandbars – Gavins Point River Segment 2007

Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	210	51.2	35	29.4	0.33
Non-Created	200	48.8	84	70.6	0.84
Total	**410**	**100.0**	**119**	**100.0**	**0.58**

On the Gavins Point river segment, slightly more than half of the tern adults were on the three created sandbar complexes. However, less than 30 percent of the fledglings came from these three sites. The fledge ratio for the created sandbars was a little more than a third of the 0.94 fledge-ratio goal. For the non-created sandbars, the fledge ratio was more than double that of the created sandbars but was still below the 0.94 fledge-ratio goal.

RPM 4.3 – Rehabilitated Sandbars

The Corps has done vegetation modification on existing sandbars on Lake Oahe segment, the Fort Randall river segment, Lewis and Clark Lake segment, and the Gavins Point river segment. Vegetation modification includes the herbicide spraying of vegetation or herbicide spraying followed by the mowing of the vegetation. Vegetation modification results are listed below by segment.

4.3.a – Lake Oahe Segment: In fall 2006, three sandbars and one sandbar complex were sprayed with herbicide to eliminate vegetation. Subsequently, in spring 2007, the sandbars were mowed to cut down the dead vegetation. The sandbars that received treatment were RMs 1293.0 (Rifle Range), 1286.2 (Silo), 1285.0 (Fire Island), and 1284.0 (Barrels). Due to continued drought in the upper Missouri River basin, Lake Oahe has been lowered to the point that a large part of the upper lake has returned to a riverine environment. The riverine part of Lake Oahe in 2007 extended from RM 1304 down to 1263.5. Table 12 shows the nest success between the treated and non-treated sandbars on this riverine part of Lake Oahe.

Table 12. Least Tern Nest Success by Treatment Type – Upper Lake Oahe 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful (a)	% of Total
Not Treated	33	25	5	3	75.8	75.0
Spray and Mow	11	8	3	0	72.7	25.0
Total	**44**	**33**	**8**	**3**	**75.0**	**100.0**

The table shows that there was similar nest success between the treated and non-treated sandbars. Table 13 shows the adult census and productivity results for the treated and non-treated sites.

Table 13. Least Tern Productivity by Treatment Type – Upper Lake Oahe 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Not Treated	36	64.3	15	62.5	0.83
Spray and Mow	20	35.7	9	37.5	0.90
Total	**56**	**100.0**	**24**	**100.0**	**0.88**

As with nest success, the productivity results were similar between the treated and non-treated sandbars.

4.3.b – Fort Randall River Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: Sandbars at RMs 866.9 and 866.5 were sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2005, Mow 2006 – RMs 870.0, 863.7 (part), 854.5, 854.0, 851.7 (part), 848.5, and 846.5
Spray 2005, Mow 2007 – RM 869.5 (part)

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars include sites at RMs 875.0, 869.5 (part), 863.7 (part), 855.5, and 853.4.

The nesting success for this reach by treatment type is summarized in Table 14.

Table 14. Least Tern Nest Success by Treatment Type – Fort Randall River Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Not Treated	19	10	8	1	52.6	41.3
Spray Only	2	2	0	0	100.0	4.3
Spray and Mow	25	21	3	1	84.0	54.4
Total	**46**	**33**	**11**	**2**	**71.7**	**100.0**

The table shows that the treated sandbars had a higher nest success than the non-treated sandbars. Table 15 shows the productivity of the three treatment types.

Table 15. Least Tern Productivity by Treatment Type – Fort Randall River Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Not Treated	30	40.5	0	0.0	0.00
Spray Only	0*	0.0	4	36.4	-
Spray and Mow	44	59.5	7	63.6	0.32
Total	**74**	**100.0**	**11**	**100.0**	**0.30**

*The nests at this treatment type were initiated after the adult census was completed, and that is the reason why 0 adults are listed for spray only.

The table shows there was no productivity for non-treated sites; and, while there was productivity for the treated sandbars, the productivity was only a third of the 2003 BiOp Amendment fledge-ratio goal of 0.94.

4.3.c – Lewis and Clark Lake Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: The sandbar at RM 839.5 was sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2004, Mow 2006 – RM 838.2
Spray 2005, Mow 2006 – RM 839.0
Spray 2005, Mow 2007 – RMs 842.2, 838.0, and 837.0

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars include sites at RMs 843.3, 842.8, 842.6, 841.9, 840.0, 839.7, 838.6, 836.0, 835.0 834.3, 832.2, 830.3, 828.4, and 827.0. In addition to these natural sandbars, in 2007, there were the created sandbars at RMs 826.6 and 826.5. Table 16 shows the nest success for the treatment types.

Table 16. Least Tern Nest Success by Treatment Type – Lewis and Clark Lake Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	70	47	9	14	67.1	75.3
Not Treated	23	9	13	1	39.1	24.7
Spray	0	0	0	0	0.0	0.0
Spray and Mow	0	0	0	0	0.0	0.0
Total	**93**	**56**	**22**	**15**	**60.2**	**100.0**

The table shows that least terns did not nest on the treated sites in 2007. Table 17 shows the productivity for the treatment types.

Table 17. Least Tern Productivity by Treatment Type – Lewis and Clark Lake Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	52	61.2	56	83.6	2.15
Not Treated	33	38.8	11	16.4	0.67
Spray	0	0.0	0	0.0	0.00
Spray and Mow	0	0.0	0	0.0	0.00
Total	**85**	**100.0**	**67**	**100.0**	**1.58**

The table shows that there was no productivity for the treated sites in 2007.

4.3.d – Gavins Point River Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: Sandbars at RMs 796.3, 768.0, and 759.5 were sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2004, Mow 2005 – RM 781.5
Spray 2004, Mow 2005 and 2006 – RM 756.7
Spray 2004 and 2005, Mow 2007 – RM 777.7
Spray 2005, Mow 2006 – RMs 801.1, 759.2, 757.2
Spray 2005, Mow 2007 – RMs 799.0, 796.3, 795.3, 793.6, 793.3, 790.9, 789.6, 786.1, 785.2, 784.5, 783.0, 782.5, 778.5, and 773.0

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars

include sites at RMs 808.2, 807.6 (shoreline), 807.3, 807.2, 804.6, 804.5, 803.4, 802.5, 801.3, 791.5, 788.5, 779.2, 779.1, 779.0, 778.9, 777.5, 777.0, 776.4, 775.2, 764.5, and 760.0. In addition to these natural sandbars, there were also the created sandbars at RMs 770.2, 770.1, 770.0, 769.9, 761.3, 755.0, and 754.2. Table 18 shows the nest success for the treatment types.

Table 18. Least Tern Nest Success by Treatment Type – Gavins Point River Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	133	110	20	3	82.7	47.3
Not Treated	126	71	47	8	56.3	44.9
Spray	0	0	0	0	0.0	0.0
Spray and Mow	22	17	5	0	77.3	7.8
Total	**281**	**198**	**72**	**11**	**70.5**	**100.0**

The table shows the nest success was good for the least terns on the spray and mow sites, but the terns did not use the treated sites to a great extent. Table 19 shows the productivity for the treatment types.

Table 19. Least Tern Productivity by Treatment Type – Gavins Point River Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	210	51.2	35	29.4	0.33
Not Treated	167	40.7	80	67.2	0.96
Spray	0	0.0	0	0.0	0.00
Spray and Mow	33	8.1	4	3.4	0.24
Total	**410**	**100.0**	**119**	**100.0**	**0.58**

The table shows that the treated sites had a fledge ratio that was a little more than a quarter of the 2003 BiOp Amendment fledge-ratio goal, while the non-treated sites had a fledge ratio that was slightly above that of the 2003 BiOp Amendment goal.

RPM 6 – Reduce Human Disturbance of Least Terns and Conduct Outreach and Education

RPM 6.1 – Human Restriction Measures

6.1.a – Markers: To deter human disturbance and increase awareness of endangered species, restriction signs and spacer stakes with orange twine were placed around least tern nesting sites. The signs, stakes, and twine created a "psychological barrier" that delineated the nesting sites for the public. Listed below are the sites where restrictions were posted by segment.

1. Garrison River Segment: Restriction signs were placed around nesting sites on the sandbar at RM 1319.9 (Heskett).
2. Lake Oahe Segment: Restriction signs were placed around nesting sites at RMs 1232.0 (State line), 1199.0 (old railroad grade), 1088.0 (Cow Creek), and at 1083.0 (Peoria Flat).
3. Lake Francis Case Segment: A single least tern nest was found near RM 881 (North Point Campground). The area was posted with restriction signs and fenced by Fort Randall Project personnel. The site was monitored by SDGFP personnel to prevent North Point campers from disturbing the nest.
4. Fort Randall River Segment: Sandbars at RMs 875.0, 870.2, 869.5, 867.1, 866.5, 863.7, 854.7, 854.0, 851.9, and 851.7 were fenced and signed.
5. Lewis and Clark Lake Segment: The sandbar at RM 835.0 and the created islands at RM 826.6 and RM 826.5 were posted with restriction signs.
6. Gavins Point River Segment: Restriction signs and orange twine fencing were placed around nesting sites on sandbars at RMs 808.2, 807.3, 807.2, 804.6, 804.5, 796.8, 795.3, 791.5, 789.6, 788.5, 786.0, 782.5, 770.2, 770.1, 770.0, 769.9, 761.3, 756.6, 755.0, and 754.5.

6.1.b – Surveillance: Protection of least tern nesting sites was coordinated with law enforcement officers from SDGFP and the USFWS. Conservation officers from the SDGFP conducted deterrence patrols throughout the nesting season on the Fort Randall and Gavins Point river segments. In July, Special Agent Rich Grosz of the USFWS conducted a surveillance of the sandbar at RM 1319.9 on the Garrison river segment.

6.1.c – Losses: Despite these measures, there were some losses due to human disturbance. In 2007, two least tern nests were destroyed by humans on the Missouri River. The losses were as follows:

1. Lake Sakakawea Segment – RM 1455.7 – Van Hook Islands: On the July 5, 2007, visit to a small island in the Van Hook Arm, the survey crew discovered that tern nest 073159 was missing. They noted that there were many human foot prints on the island and around the nest bowls.

2. Lake Oahe Segment – RM 1150.5 – Forest City: On the July 6, 2007, visit to this site, the crew found that tern nest 075070 had been lost to human disturbance. The nest was destroyed by a vehicle driving off-road.

RPM 6.4 – Outreach and Education

Outreach efforts in 2007 included giving presentations for civic organizations, schools, environmental groups, and campfire programs; writing articles for area newspapers; talking to the public in the field; and handing out the "Missouri River Species at Risk" brochure to area businesses and the public.

IV.C.3. Kansas River Least Terns

IV.C.3.a. Incidental Take

Eight least tern chicks were lost on the Kansas River in 2007 due to Corps' operations.

IV.C.3.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Least Terns, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2007, an adult census and productivity monitoring were conducted for least terns on the Kansas River. The adult census for least terns was 20. In 2007, 12 least tern nests, containing 25 eggs, were found on the Kansas River. Of the 12 nests found, 8 were successful, for a nest success of 75.0 percent. Five least tern chicks fledged. The fledge ratio for 2007 was 0.50 fledglings per adult pair.

RPM 1.2 – Mortality

1.2.a - Nest Fates: In 2007, there were 12 least tern nests on the Kansas River. Of these nests, eight were successful (at least one egg hatched from the nest). For the four non-successful nests, the nest fates are as follows:

1. Predation – 2 nests: Predators include mink, raccoons, coyotes, owls, gulls, crows, and other mammal and avian species.
2. Abandoned – 2 nests: There are nests that were abandoned by the adults.

1.2.b - Adult and Chick Mortality: Survey personnel did not find any dead adults or chicks in 2007.

1.2.c – Measures taken to reduce mortality: The Corps and USFWS undertook the following activity to reduce least tern chick mortality.

Chick Moving: Eight unfledged least tern chicks were moved from their natal sandbar to a sandbar with higher elevation after it was determined that the natal sandbar would be inundated due to the Corps

operation of the Tuttle Creek Dam. On the day following the move to the higher sandbar, survey personnel observed three of the chicks being fed by the adults. However, on the next survey of the site, no adults or chicks were found on the release site. Numerous coyote tracks were found on the sandbar, and it was assumed the chicks were killed by predators. Because the natal sandbar was inundated by the Corps operations at Tuttle Creek Dam, the eight chicks were considered incidental take.

RPM 2 – Monitor, Evaluate, and Adjust Operations to Minimize Take of Least Terns

RPM 2.2 – Water Management Coordination

Throughout the nesting season, representatives of the Corps' Kansas City District participated in conference calls held between the Corps' Water Management Division, the Corps' Threatened and Endangered Species Section, and the USFWS. During these calls, Kansas City District personnel updated the situation on how Corps operations on Kansas River tributaries could affect least terns nesting on the Kansas River.

IV.C.4. Missouri River Piping Plovers

IV.C.4.a. Incidental Take

The USFWS, in its 2003 BiOp Amendment, listed six categories in which incidental take for the piping plover were expected to occur. Listed below are the six incidental take categories and the results for 2007.

1. Take (Killing) of Eggs and Chicks by Flooding on the River and Reservoir Reaches that Results from the Corps' Operation of the Water Control System

In its 2003 BiOp Amendment, the USFWS set two standards of incidental take in regard to Corps operations:

a. Incidental take should not exceed by more than 10 percent of a 10-year average of 8.4 percent of all eggs. (This is the amount of take that occurred due to Corps operations from 1993 through 2003.) The 10-percent variance results in a lower limit of 7.6 percent and an upper limit of 9.2 percent.

b. Take should not exceed that observed from 1993 through 2003 in any single year. This was quantified as the lesser of 294 eggs (1995) or 46 percent of all eggs (1996).

In 2007, 213 of 2,628 piping plover eggs (8.1 percent) were lost due to Corps operations. This is below both the 294 eggs and the 46 percent of all eggs standards set forth in the 2003 BiOp Amendment. The 10-year running average of plover eggs lost to Corps operations, 1998-2007, was 4.3 percent (912 of 21,297). This is well below the 9.2-percent upper limit of losses set by the USFWS in the 2003 BiOp Amendment.

2. Take (Harm) of Eggs, Chick, or Adults by Predation

In its 2003 BiOp Amendment, the USFWS noted that 4.0 percent of monitored nests were lost to predation from 1993 through 2003. The USFWS expected take could be quantified as being outside of a 10-percent variance of that 4.0-percent loss and set loss from predation as being from 3.6 percent to 4.4 percent as a 10-year running average. In 2007, 41 of 671 plover nests were lost to predation for a loss rate of 6.1 percent. The 10-year running average, 1998-2007, was 4.4 percent (262 of 5906), which is at the upper limit of the 3.6- to 4.4-percent tolerance set forth in the 2003 BiOp Amendment.

3. Take (Harm) of Eggs, Chicks, or Adults by Human Disturbance

In its 2003 BiOp Amendment, the USFWS did not consider take from human disturbance on the reservoir segments and quantified take only from the riverine segments. The USFWS noted that 1.5 percent of monitored nests on the riverine segments were lost to human disturbance from 1993 through 2003. The USFWS expected take could be quantified as being outside of a 10-percent variance of that 1.5-percent loss and set loss from human disturbance as being from 1.4 to 1.7 percent as a 10-year running average. In

2007, 8 of 320 plover nests on the riverine segments were lost to human disturbance, for a loss rate of 2.5 percent. The 10-year running average, 1998-2007, was 1.4 percent (35/2,473), which is within the 1.4- to 1.7-percent tolerance set forth in the 2003 BiOp Amendment.

4. Take (Harm) of Chicks as a Result of Insufficient Forage in River Reaches Affected by Hypolimnetic Releases

The USFWS, in its 2003 BiOp Amendment, noted that hypolimnetic hydropower releases from Fort Peck, Garrison, and Fort Randall Dams would continue to provide unsuitable water temperatures below the dams and negatively impact production at all trophic levels. The USFWS quantified take in the form of fledge ratios for these three segments with a variance of not to exceed by more than 10 percent the fledge ratios on these segments for 1993-2003. The 1993-2003 fledge ratio was below Fort Peck Dam, 1.33 (1.20-1.46 variance); below Garrison Dam, 1.18 (1.06-1.30 variance); and below Fort Randall Dam, 0.92 (0.83-1.01 variance).

The USFWS made no mention of a 10-year running average for these fledge ratios, but since 10-year running averages were used for the other five measures of take, it is the Corps' interpretation that this was an omission on the part of the USFWS, and the Corps has included the 10-year running average along with the 2007 fledge ratios.

For the Fort Peck river segment, the 2007 fledge ratio was 0.00, while the 10-year running average for 1998-2007 was 1.10 (17 fledglings per 15.5 adult pairs). This is below the 1.20 lower-limit fledge ratio set forth in the 2003 BiOp Amendment.

For the Garrison river segment, the 2007 fledge ratio was 0.97, while the 10-year running average for 1998-2007 was 1.18 (856 fledglings per 727 adult pairs). This is within the limit of the 1.06- to 1.30-variance fledge ratio set forth in the 2003 BiOp amendment.

For the Fort Randall river segment, the 2007 fledge ratio was 0.00, while the 10-year running average for 1998-2007 was 0.82 (151 fledglings per 184 adult pairs). This is below the 0.83-1.01 limits fledge ratio set forth in the 2003 BiOp Amendment.

5. Take (Harm) of Eggs in Nests Assigned Fates of Destroyed-Unknown, Nest Abandonment, Sandbar Erosion, and Unknown Fates

The USFWS, in its 2003 BiOp Amendment, noted that the 1993-2003 fledge ratio for piping plovers on the Missouri River system was 1.36 fledglings per adult pair. The USFWS quantified take for nests assigned fates of destroyed (no evidence, nest abandonment, sandbar erosion, and undetermined fates) as being greater than 10-percent variance from that fledge ratio (1.22-1.47) for a 10-year running average. The 10-year running average for 1998-2007 was 1.29 (7,214 fledglings per 5,588 adult pairs), which is within the 10-percent variance set by the USFWS.

6. Take (Harm) of Chicks as a Result of Insufficient Forage on Created Habitats

In its 2003 BiOp Amendment, the USFWS noted that piping plover chicks may starve on created habitats due to insufficient forage. The USFWS anticipated that fledge ratios in the created habitats would approximate those observed from 1993 through 2003, 1.36 fledglings per pair. The USFWS, in the 2003 BiOp Amendment, stated that there may be a variance of as much as 10 percent from the 1.36 fledge ratio and, therefore, set a range of 1.22-1.47 fledge ratios based on a 10-year running average for take compliance. The Corps habitat creation efforts in the early 1990s were destroyed by high releases from the Garrison, Fort Randall, and Gavins Point Dams in 1995, 1996, and 1997. Habitat was created at three sites on the Gavins Point river segment (RMs 770.0, 761.3, and 755.0) in 2004 and 2005 and at one site on the Lewis and Clark Lake segment (RM 826.5) in 2006-2007. The fledge ratio for these created habitat sites is, therefore, based on the 4 past years of habitat creation and not the 10-year running average. For 2004-2007, the fledge ratio for created habitat was 1.27 fledglings per adult pair (299 fledglings per 235 adult pairs), which is within the 1.22-1.47 fledge ratios set forth in the 2003 BiOp Amendment.

IV.C.4.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor All Plover Sites on the Missouri and Kansas Rivers

RPM 1.1 – Summary Data

In 2007, an adult census and productivity monitoring were conducted for piping plovers on the Missouri River. The adult census was 1,251. In 2007, 745 piping plover nests and broods (671 nests and 74 broods) were found on the Missouri River. Of the 671 nests found, 337 nests were successful, for an apparent nest success of 50.4 percent. In 2007, 413 piping plover chicks fledged. The fledge ratio for 2007 was 0.66 fledglings per adult pair. Table 20 summarizes piping plover adult census and productivity by segment in 2007.

Table 20. Adult Census and Productivity Monitoring of the Piping Plover on the Missouri River 2007

Segment	Adult Census	Nests	Broods	Nests Hatched	% Nest Success (a)	Number of Eggs	Number of Chicks	Total Chicks Fledged	Fledge Ratio (b)
Segment 1 - Fort Peck Lake	16	8	2	6	75.0	35	27	4	0.50
Segment 2 - Fort Peck River	0	0	0	0	0.0	0	0	0	0.00
Segment 3 -Lake Sakakawea	399	137	46	51	37.2	602	292	140	0.70
Segment 4 - Garrison River	222	126	8	79	63.2	491	316	108	0.97
Segment 5 -Lake Oahe	273	191	10	72	37.9	719	278	84	0.62
Segment 7 -Lake Francis Case	0	0	0	0	0.0	0	0	0	0.00
Segment 8 - Fort Randall River	21	23	1	7	30.4	82	29	0	0.00
Segment 9 -Lewis and Clark Lake	20	15	1	11	73.3	58	46	18	1.80
Segment 10 - Gavins Point River	300	171	6	111	64.9	651	446	59	0.39
Total	**1,251**	**671**	**74**	**337**	**50.4**	**2,638**	**1,434**	**413**	**0.66**

(a) %Nest Success = (HN/N)*100, where HN= hatched nests and N=number of nests
(b) Fledge Ratio = number of fledged chicks per pair of adult birds

RPM 1.2 – Survival and Take Information

The fledge ratio for the Missouri River in 2007 was 0.66 fledglings per adult pair. Table 20 shows a segment by segment breakdown of fledge ratios.

The USFWS in this section requests a "quantification of take, including loss of eggs, chicks, adults, and habitat that occurred … along with the reasons or causes for take and any actions the Corps may have taken to avoid take." In 2007, there was a take of at least 2 adults, 1,204 eggs (2,638 eggs – 1,434 chicks), and 1,021 chicks (1,434 chicks – 413 fledglings). Take of chicks and eggs occurred from a variety of events. Nest-loss causes are listed in the next section. For nests, where the cause could be determined, the highest losses were due to: weather events (66 nests), flooding (62 nests), and predation (41 nests). Determining the cause of take for chicks is difficult because, generally, there is very little evidence. In 2007, survey crews found the remains of just 17 chicks. Action taken by the Corps to avoid take include management of water releases from the dams to minimize flood events, use of predator cages to protect nests, placement of restriction signs around nesting and brooding areas to avoid human disturbance, and the raising and moving of nests to avoid inundation.

Habitat losses have not been quantified at the time this report was written, but habitat was lost due to erosion, the rising of the reservoirs eliminating beach habitat, and vegetation encroachment on the shoreline beaches and sandbars.

RPM 1.3 – Nest and Egg Losses

Nest Fates: In 2007, there were 671 piping plover nests found on the Missouri River. Of these, 337 were successful (at least one egg hatched from the nest). In addition to these successful nests, there were 74 plover broods that were found that could not be associated with any previously known nest. The nest success was at 50.4 percent. For the 274 non-successful nests, the nest losses are categorized below. Included in the list of nest losses is an estimate of egg losses as per RPM 1.3 on page 252 of the 2003 BiOp Amendment. RPM 1.3 states, "Methods of analysis that accurately (e)stimate the number of eggs in destroyed nests at the time of their destruction shall be used. For example, a nest is visited during the laying period before a full modal clutch size of four (Haig 1992) had been laid. On the next visit, 7 days later, the nest has been destroyed. The estimate should be based on the number of eggs observed plus an assumption that the following eggs were laid at a rate of 1 egg per 1.5 days."

1. Flooded (Non-Corps Operations) – 5 nests (15 eggs known, 20 eggs maximum): These nests were lost to rising river levels as a result of rain storms in the area.
2. Flooded (Corps Operations) – 57 nests (190 eggs known, 216 maximum): These nests were lost due to Corps operation of the Missouri River dams.
3. Weather (Non-Corps Operations) – 60 nests (219 eggs known, 226 eggs maximum): These were nests lost to weather events such as rain, hail, wave action, and wind.
4. Weather (Corps Operations) – 6 nests (23 eggs known, 23 maximum): These nests were lost to wave action as a result of Corps operations involving Lake Sakakawea, Lake Oahe, and Fort Randall Dam.
5. Predation – 41 nests (153 eggs known, 156 eggs maximum): Predators include mink, raccoons, coyotes, owls, gulls, crows, and other mammal and avian species.
6. Livestock – 1 nest (4 eggs known, 4 eggs maximum): This nest was destroyed by livestock stepping on it.
7. Bank Erosion – 2 nests (8 eggs known, 8 eggs maximum): These nests were lost due to the river eroding away nest sites.
8. Wildlife – 1 nest (1 egg known, 1 egg maximum): This nest was stepped on by a beaver (*Castor canadensis)*.
9. Human Disturbance – 7 nests (19 eggs known, 26 eggs maximum): These nests were lost to human activity.
10. Researcher – 1 nest (4 eggs known, 4 eggs maximum): This nest was accidently destroyed by a researcher.
11. Destroyed, No Evidence – 61 nests (187 eggs known, 216 eggs maximum): These were nests that were destroyed before the eggs could have hatched, but for which no cause could be determined by the survey crew.
12. Abandoned – 24 nests (72 eggs known, 75 eggs maximum): These are nests that were abandoned by the adults.
13. Non-Viable Eggs – 8 nests (34 eggs known, 34 maximum): These are nests in which the eggs were not viable, but were still incubated by the adults.
14. Fate Undetermined – 58 nests (220 eggs known, 220 eggs maximum): These are nests where the egg incubation was far enough along, that the eggs could have hatched between site visits. However, the crew could find neither evidence of egg hatching nor evidence that the nest had been destroyed prior to the subsequent nest visit. In this category, the incubation stage was far enough along that the clutch was complete and no more eggs would have been laid between site visits.

RPM 1.4 – Habitat Mapping

The Corps contracted with the USGS-NPWRC to develop and evaluate methods to inventory, monitor, and estimate least tern and piping plover habitats using Quickbird imagery. In 2007, Quickbird imagery was captured for the Fort Peck river segment, Garrison river segment, Upper Lake Oahe segment, Fort Randall river segment, upper Lewis and Clark Lake segment, and the Gavins Point river segment.

RPM 2 – Documenting Take of Piping Plovers

RPM 2.1 – Incidental Take

The USFWS requires that the Corps document take that occurs due to Corps operation of the Missouri River System. In 2007, Corps operations were responsible for the loss of 213 piping plover eggs from 63 nests and 1 chick for a total of 214. The egg losses came as a result of five events. The events are listed in chronological order, though it should be noted that the losses on Lake Sakakawea occurred over a wide period of time. The chick loss is described in RPM 2.2 – Adult and Chick Mortality.

1. May-June 2007 Lake Sakakawea Rise: Lake Sakakawea is operated to rise from May through July to capture snow pack runoff from the Northern Rockies, primarily from the Yellowstone River Basin. At the time of the first piping plover nest initiation on April 21, 2007, the lake level of Lake Sakakawea was at 1808.6 feet msl. During the nesting season, the lake rose nearly 10 feet and peaked on July 10 at 1818.3 feet msl. Thirty-seven piping plover nests with 130 eggs were inundated by the rise of the lake or were lost to wave action as the lake rose. Efforts to move nests to higher locations were largely unsuccessful because either the nests were on small islands that were inundated or encroaching vegetation made it impossible to move the nests.

2. May 2007 Authorized Project Purpose Support: In mid-May 2007, releases were increased out of Garrison, Fort Randall, and Gavins Point Dams to meet authorized project purposes. Garrison Dam releases were increased incrementally from an average of 11,000 cfs to an average of 17,000 cfs on May 19-22. Fort Randall Dam releases were increased from an average of 2,000 cfs on May 17 to an average of 15,000 cfs by May 31. On May 20, releases from Gavins Point Dam were increased from 8,000 cfs to 14,000 cfs. The increases resulted in the loss of 17 Piping Plover nests containing 51 eggs.

3. May 2007 Lake Oahe Rise: The rise of Lake Oahe during May 2007 caused the loss of one piping plover nest containing four eggs.

4. June 2007 Lake Oahe Rise: Lake Oahe rose slowly throughout June 2007. The combination of the lake rise and wave action caused the loss of three piping plover nests containing 11 eggs.

5. July 2007 Navigation Support: On July 5, 2007, releases from Fort Randall Dam were 17,200 cfs, and releases out of Gavins Point Dam were 18,000 cfs. Over the next 6 days (to July 11, 2007), releases were increased to 22,200 cfs from Fort Randall Dam and 21,000 cfs out of Gavins Point Dam to meet navigation flow targets in the navigation channel on the lower Missouri River. The total losses from this event were five piping plover nests containing 17 eggs.

RPM 2.2 – Adult and Chick Mortality

Per RPM 2.2, survey crews were instructed to try to determine a cause of death for piping plover adults and chicks found on site. If a cause of death could not be determined and the specimen was fresh (little to no decomposition), the specimen was then sent to the NWHC in Madison, Wisconsin, for analysis.

In 2007, the remains of two piping plover adults and 17 chicks were found by survey crews. The specimens are listed by segment and date.

1. Lake Sakakawea Segment – 7 chicks

June 17, 2007: Five chicks, approximately 5 days old, were found dead on a small island that is a part of the Seven Sisters complex in the eastern part of the lake. The five were grouped together, and the crew suspected the cause of death was exposure or drowning from a heavy rainstorm.

July 17, 2007: One 4-day-old chick was found dead along the shore of Shell Village Island. The chick was too decomposed to send in for necropsy. The crew noted that thunderstorms had passed through area during the previous week.

July 18, 2007: One 10-day-old chick was found dead along the north shore of the Van Hook Arm. No cause of death could be determined, and the chick was too decomposed for necropsy.

2. Garrison River Segment – 1 adult, 3 chicks

June 22, 2007: One adult was found dead on a sandbar at RM 1339.3. The specimen was sent to the NWHC for necropsy. The necropsy revealed the piping plover to be in excellent nutritional condition, and the cause of death was trauma to the abdomen as a result of a puncture wound. Tests for the West Nile virus were negative.

July 2, 2007: One 6- to 10-day-old chick was found dead on a sandbar at RM 1364.5. No cause of death could be determined, and the chick was too decomposed for necropsy.

July 3, 2007: Two 2-day-old chicks were found dead on a sandbar at RM 1380.0. The crew believed the two had been attacked by an avian predator.

3. Lake Oahe Segment – 1 chick

June 12, 2007: One 1-day-old chick was found dead on the shoreline of Cow Creek Bay. The chick became caught by the neck under the metal cage placed over the nest to protect the nest from predators. The chick could not free itself and died. This chick loss is considered incidental take due to Corps operations.

4. Gavins Point River Segment – 1 adult, 5 chicks

June 13, 2007: One 3-day-old chick was found dead on a sandbar at RM 782.5. No cause of death could be determined, and the chick was too decomposed for necropsy.

June 14, 2007: Two 1-day-old and one 3-day-old chick were found dead on the created sandbar complex at RM 761.3. The two 1-day-old chicks were found on the west side of the sandbar, just outside of caged nest 0710203. The 3-day-old chick was found on the east side of the sandbar, 1 foot away from nest 0710014. The three specimens were sent to the NWHC for necropsy. A cause of death could not be determined for the three chicks; however, tests for avian influenza were negative, and no viruses were isolated from the lungs.

July 9, 2007: One adult was found on a sandbar at RM 779.2. There were no obvious signs of a cause of death, and it was too decomposed to send for necropsy.

July 13, 2007: One 2-day-old chick was found dead on a sandbar at RM 788.5. The chick was collected by the research crew from the Virginia Polytechnic Institute.

RPM 3 – Coordinating Operations to Minimize Take

Throughout the nesting season, representatives of the Corps' Water Management Division, Corps' Threatened and Endangered Species Section, and USFWS held conference calls every Monday, Wednesday, and Friday to discuss water releases from the Missouri River dams and their effects on piping plovers. These calls were used to discuss impending changes to water release schedules relative to nests and sandbars that have been identified as "at risk" due to Corps operations, to assess risk, and to discuss alternatives to proposed actions. The calls provided timely information throughout the 2007 nesting season and helped to minimize incidental take by Corps operations. The Corps also discussed with the USFWS the steady release, flow-to-target water management operation before nesting commenced on the river.

RPM 4 – Moving Eggs to Higher Elevation to Avoid Flooding

In 2007, eight plover nests were moved to a higher location to avoid loss by flooding, five nests were raised in place to provide a higher elevation, and two nests were both moved and raised. Table 21 shows the results of these three actions.

Table 21. Piping Plover Nest Moving, Raising, and Moving, and Raising 2007

Type	Nests	Successful	% Suc.	FL	PR	WE	AB	DN	UN
Moved	8	1	12.5	2	1	2	1	0	1
Raised	5	0	0.0	2	2	0	0	1	0
Moved and Raised	2	1	50.0	0	0	0	1	0	0
Total	**15**	**2**	**13.3**	**4**	**3**	**2**	**2**	**1**	**1**

Successful = at least one egg hatched, FL = flooded, PR = predation, BE = bank erosion, AB = abandoned, DU = destroyed, no evidence, UN = undetermined fate, NV = non-viable eggs

The results show the efforts generally were unsuccessful, with only two nests subsequently being successful, for a nest success of 13.3 percent. The nests were lost to a variety of causes, but flooding had the highest number with four.

RPM 5 – Reduce Human Disturbance of Piping Plovers and Conduct Outreach and Education

RPM 5.2 – Outreach Efforts

Outreach efforts in 2007 included giving presentations for civic organizations, schools, environmental groups, and campfire programs; talking to the public in the field; writing articles for area newspapers; and distributing the "Missouri River Species at Risk" brochure to area businesses and the public.

RPM 5.3 – Human Restriction Measures

To deter human disturbance and increase awareness of endangered species, restriction signs and spacer stakes with orange twine were placed around piping plover nesting sites. The signs, stakes, and twine created a "psychological barrier" that delineated the nesting sites for the public. Listed below are the segments and sites where restrictions were posted.

1. Lake Sakakawea Segment: During the 2007 season, preemptive measures were again taken to deter infractions on Corps fee title land. "No off road vehicles" signs were placed at Red Mike (RM 1510), and the area was fenced to deter off-road traffic. A seasonal ranger was again assigned to patrol shoreline areas, including endangered species habitat, to deter off-road vehicle use. At Indian Hills (RM 1429), restriction signs were placed, and a piping plover nesting site was fenced off due to the proximity of a low-water, temporary boat ramp. At Gull Island (RM 1452) one piping plover nest was found in the vicinity of the low-water boat ramp. The area was fenced and restriction signs were placed. Restriction signs were placed at the West Totten Recreation Area (RM 1393) to warn the public of nesting piping plovers.
2. Garrison River Segment: Restriction signs were placed around nesting sites on the sandbar at Heskett (RM 1319.9).
3. Lake Oahe Segment: Restriction signs were placed around nesting sites at RMs 1232.0 (State line), 1199.0 (old railroad grade), 1088.0 (Cow Creek), and at 1083.0 (Peoria Flat).
4. Fort Randall River Segment: Sandbars at RMs 875.0, 870.2, 869.5, 867.1, 866.5, 863.7, 854.7, 854.0, 851.9, and 851.7 were fenced and signed.
5. Lewis and Clark Lake Segment: The sandbar at RM 835.0 and the created islands at RMs 826.6 and 826.5 were posted with restriction signs.
6. Gavins Point River Segment: Restriction signs and orange-twine fencing were placed around nesting sites on sandbars at RMs 808.2, 807.3, 807.2, 804.6, 804.5, 796.8, 795.3, 791.5, 789.6, 788.5, 786.0, 782.5, 770.2, 770.1, 770.0, 769.9, 761.3, 756.6, 755.0, and 754.5.

Protection of piping plover nesting sites was coordinated with law enforcement officers from the SDGFP and the USFWS. Conservation officers from the SDGFP conducted deterrence patrols throughout the nesting season on the Fort Randall and Gavins Point river segments. In July, Special Agent Rich Grosz of the USFWS conducted a surveillance of the sandbar at RM 1319.9 on the Garrison river segment.

RPM 6 – Predator Management

RPM 6.1 – Predator Trapping

In 2007, the Corps contracted with the USDA to trap Great Horned Owls on sandbars used by piping plovers at one location on the Lewis and Clark Lake segment and several locations on the Gavins Point river segment. A summary of the trapping effort can be found under least tern RPM 1.2c.

RPM 6.2 – Predator Exclosures

Wire mesh cages were used in 2007 to protect piping plover nests from mammalian and avian predators. The cages consist of 3-foot by 3-foot by 3-foot wire mesh cages containing 2- by 4-inch openings. The cages are placed over the piping plover nests and anchored into the substrate with metal stakes at the four corners. After placing a cage, the surveyors retreat and watch the cage to ensure that the piping plover returns to the nest inside the cage. If the piping plover refuses to enter the cage, the cage is removed. When a nest is terminated, the cage is removed.

As a general rule, cages were placed over piping plover nests located on riverine segments. For nests on a reservoir segment, it is left to the judgment of the crew whether or not to place cages. The rationale for not placing cages over nests on reservoirs is that most piping plover nests on reservoirs are in remote, spread-out locations and may not be subject to predator pressure. Table 22 shows, by segment, the number of caged nests, the number successful nests that were caged, percent success of nests that were caged, the number of nests that were not caged, the number of successful nests that were not caged, and percent success nests that were not caged.

Table 22. Piping Plover Caged vs. Non-Caged Nests by Segment 2007

Segment	Caged Nests	Successful Caged Nests	% Suc. Caged Ness	Non-Caged Nests*	Successful Non-Caged Nests*	% Suc. Non-Caged Nests
Fort Peck Lake	0	0	0.0	8	6	75.0
Lake Sakakawea	0	0	0.0	137	51	37.2
Garrison River	81	62	76.5	45	18	40.0
Lake Oahe	106	48	45.3	85	25	29.4
Fort Randall River	11	5	45.5	12	2	16.7
Lewis and Clark Lake	6	5	83.3	9	6	66.7
Gavins Point River	66	59	89.4	105	52	49.5
Total	**270**	**179**	**66.3**	**401**	**160**	**39.9**

*Not included in the non-caged nests and successful non-caged nests are the 74 piping plover broods that were never found as nests

In 2007, 40.2 percent (270 of 671) of all piping plover nests were caged. Overall, nest success was far higher for caged piping plover nests at 66.3 percent, compared to 39.9 percent for non-caged nests.

The causes for nest losses for caged vs. non-caged nests are shown in Table 23.

Table 23. Piping Plover Caged vs. Non-Caged Nest Percent Losses by Cause 2007

Cause	% Caged Nests	% Non-Caged Nests
Flooding	1.1	15.0
Weather	8.5	10.5
Predation	3.7	8.5
Bank Erosion	0.0	0.05
Human Disturbance	1.1	1.2
No Evidence	5.2	11.7
Abandoned	3.7	3.5
Non-Viable Eggs	1.5	1.0
Undetermined	8.9	8.5

Predation was the cause of loss for 3.7 percent (10 of 270) of the caged nests and for 8.5 percent (34 of 401) of the losses for non-caged nests. Although there was a distinct advantage for caging a piping plover nest to deter predation, this was not the case everywhere. For a second consecutive year, there was evidence of a "smart" predator that keyed on the presence of a cage to get to a nest. As in 2006, this occurred on Lake Oahe, this time at Stateline Bay. Ten piping plover nests had been found and caged at this location before or during the site

visit of May 31, 2007. On the next visit on June 6, seven of these nests had been destroyed by a predator that dug under and crawled into the cage to get to the eggs. The survey crew removed the cages from the three surviving nests, but none of these nests subsequently were successful.

RPM 8 – Monitor and Evaluate Effectiveness of Created and Rehabilitated Sandbars

8.A – Created Sandbars

The Corps constructed sandbar complexes on the Gavins Point river segment in 2004 at RM 755.0 and in 2005 at RMs 770.0 and 761.3. In fall 2006 and spring 2007, construction on a sandbar complex in the Lewis and Clark Lake segment at RM 826.0 was begun. Construction of this complex was not completed by the time piping plovers arrived in 2007, and work was halted until after the end of the nesting season.

Piping plovers used all four created sandbar complexes in 2007. Tables 24 and 25 show nest success on the created sandbars versus the non-created sandbars on the Lewis and Clark Lake segment and the Gavins Point river segment.

Table 24. Piping Plover Nest Success: Created Sandbars vs. Non-Created Sandbars – Lewis and Clark Lake Segment 2007

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	13	11	1	1	84.6	81.3
Non-Created	3	1	2	0	33.3	18.7
Total	**16**	**12**	**3**	**1**	**75.0**	**100.0**

The table shows that most of the plover nests for the Lewis and Clark Lake segment were found on the created sandbar complex and that they had a high nest success.

Table 25. Piping Plover Nest Success: Created Sandbars vs. Non-Created Sandbars – Gavins Point River Segment 2007

Habitat Type	Total # of Nests	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	88	71	15	2	80.6	49.7
Non-Created	89	46	38	5	51.7	50.3
Total	**177**	**117**	**53**	**7**	**66.1**	**100.0**

The table shows that three created sandbar complexes had nearly the same number of nests as all of rest of the Gavins Point river segment combined. The created sandbar complexes also had a very high nest success, which was also much higher than the non-created sandbars.

Tables 26 and 27 show the number of adults, percent of total adults, number of fledglings, percent of total fledglings, and fledge ratios for created versus non-created sandbars for the two segments.

Table 26. Piping Plover Adults, Fledglings, and Fledge Ratios: Created Sandbars vs. Non-Created Sandbars – Lewis and Clark Lake Segment 2007

Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	16	80.0	18	100.0	2.25
Non-Created	4	20.0	0	0.0	0.00
Total	**20**	**100.0**	**18**	**100.0**	**1.80**

Table 26 shows that, on the Lewis and Clark Lake segment, the majority of the adults and all of the fledglings were on the created sandbars. The created sandbars had a very high fledge ratio of 2.25 fledglings per adult

pair. This fledge ratio was 1.03 fledglings per pair higher than the 2003 BiOp Amendment fledge-ratio goal of 1.22 for piping plovers.

Table 27. Piping Plover Adults, Fledglings, and Fledge Ratios: Created Sandbars vs. Non-Created Sandbars – Gavins Point River Segment 2007

Habitat Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	146	48.7	30	50.8	0.41
Non-Created	154	51.3	29	49.2	0.38
Total	**300**	**100.0**	**59**	**100.0**	**0.39**

On the Gavins Point river segment, slightly less than half of the plover adults were on the three created sandbar complexes. The number of fledglings for the two habitat types was very close, with the created sandbars slightly favored. However, both habitat types had very low fledge ratios compared to the 2003 BiOp Amendment fledge-ratio goal of 1.22.

8.B – Rehabilitated Sandbars

The Corps has conducted vegetation modification on existing sandbars on the Lake Oahe segment, Fort Randall river segment, Lewis and Clark Lake segment, and the Gavins Point river segment. Vegetation modification includes the herbicide spraying of vegetation or herbicide spraying followed by mowing of the vegetation. Vegetation modification results are listed below by segment.

8.B.a – Lake Oahe Segment: Fall 2006, three sandbars and one sandbar complex were sprayed with herbicide to eliminate vegetation. Subsequently, in spring 2007, the sandbars were mowed to cut down the dead vegetation. The sandbars that received treatment were: RMs 1293.0 (Rifle Range), 1286.2 (Silo), 1285.0 (Fire Island) and 1284.0 (Barrels). Due to continued drought in the upper Missouri River basin, Lake Oahe has been lowered to the point that a large part of the upper lake has returned to a riverine environment. The riverine part of Lake Oahe in 2007 extended from RM 1304 down to 1263.5. Table 28 shows the nest success between the treated and non-treated sandbars on this riverine part of Lake Oahe.

Table 28. Piping Plover Nest Success by Treatment Type – Upper Lake Oahe 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful (a)	% of Total
Not Treated	46	34	11	1	73.9	57.5
Spray and Mow	34	13	17	4	38.2	43.5
Total	**80**	**47**	**28**	**5**	**58.9**	**100.0**

The table shows that the non-treated sandbars had a much higher nest success, almost double that of the treated sandbars.

Table 29 shows the adult census and productivity results for the treated and non-treated sites.

Table 29. Piping Plover Productivity by Treatment Type – Upper Lake Oahe 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Not Treated	84	66.7	28	58.3	0.67
Spray and Mow	42	33.3	20	41.7	0.91
Total	**126**	**100.0**	**48**	**100.0**	**0.76**

There was a higher number of adults and fledglings on the non-treated sandbars than on the treated sandbars. This in itself is not surprising, considering there were only four treated sandbar complexes and the plovers nested on 18 other sandbar complexes within the riverine part of Lake Oahe. In contrast to the low nest success, the treated sandbars had a higher fledge ratio compared to the non-treated sandbars.

8.B.b – Fort Randall River Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: Sandbars at RMs 866.9 and 866.5 were sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2005, Mow 2006 – RMs 870.0, 863.7 (part), 854.5, 854.0, 851.7 (part), 848.5, and 846.5
Spray 2005, Mow 2007 – RM 869.5 (part)

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars include sites at RMs 875.0, 869.5 (part), 863.7 (part), 855.5, and 853.4.

Table 30 shows the nest success on the Fort Randall river segment between the various treatment types.

Table 30. Piping Plover Nest Success by Treatment Type – Fort Randall River Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Not Treated	6	1	5	0	16.7	25.0
Spray Only	2	1	1	0	50.0	8.3
Spray and Mow	16	6	8	2	37.5	66.7
Total	**24**	**8**	**14**	**2**	**33.3**	**100.0**

The table shows that the majority of the plover nests were on the treated sites. Nest success, with the exception of the spray only sites, was generally poor. Table 31 shows piping plover productivity for the various treatment types.

Table 31. Piping Plover Productivity by Treatment Type – Fort Randall River Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Not Treated	7	33.3	0	-	0.00
Spray Only	0	0.0	0	-	0.00
Spray and Mow	14	66.7	0	-	0.00
Total	**21**	**100.0**	**0**	**-**	**0.00**

As with the nests, the majority of the adults were on the spray and mow sites. However, no plover chicks fledged off the Fort Randall river segment in 2007.

8.Bc – Lewis and Clark Lake Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: The sandbar at RM 839.5 was sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2004, Mow 2006 – RM 838.2
Spray 2005, Mow 2006 – RM 839.0
Spray 2005, Mow 2007 – RMs 842.2, 838.0, and 837.0

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars

include sites at RMs 843.3, 842.8, 842.6, 841.9, 840.0, 839.7, 838.6, 836.0, 835.0 834.3, 832.2, 830.3, 828.4, and 827.0. In addition to these natural sandbars, in 2007 there were the created sandbars at RMs 826.6 and 826.5. Table 32 shows the nest success for the treatment types.

Table 32. Piping Plover Nest Success by Treatment Type – Lewis and Clark Lake Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	13	11	1	1	84.6	81.3
Not Treated	3	1	2	0	33.3	18.7
Spray	0	0	0	0	0.0	0.0
Spray and Mow	0	0	0	0	0.0	0.0
Total	**16**	**12**	**3**	**1**	**75.0**	**100.0**

The table shows that piping plovers did not nest on the treated sites in 2007. Table 33 shows the productivity for the treatment types.

Table 33. Piping Plover Productivity by Treatment Type – Lewis and Clark Lake Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	16	80.0	18	100.0	2.25
Not Treated	4	20.0	0	0.0	0.00
Spray	0	0.0	0	0.0	0.00
Spray and Mow	0	0.0	0	0.0	0.00
Total	**20**	**100.0**	**18**	**100.0**	**1.80**

The table shows that there was no productivity for the treated sites in 2007.

8.Bd – Gavins Point River Segment: On this segment there have been two types of vegetation modification treatments, herbicide spraying only and herbicide spraying followed by mowing. The sandbars that have undergone vegetation modification are listed below by treatment type and year of treatment.

Sprayed: sandbars at RMs 796.3, 768.0, and 759.5 were sprayed with herbicide in fall 2005, but the dead plant material was not removed.

Spray and Mowed:
Spray 2004, Mow 2005 – RM 781.5
Spray 2004, Mow 2005 and 2006 – RM 756.7
Spray 2004 and 2005, Mow 2007 – RM 777.7
Spray 2005, Mow 2006 – RMs 801.1, 759.2, and 757.2
Spray 2005, Mow 2007 – RMs 799.0, 796.3, 795.3, 793.6, 793.3, 790.9, 789.6, 786.1, 785.2, 784.5, 783.0, 782.5, 778.5, and 773.0

There are sandbars that currently, or since 1998, have had bird (least tern and/or piping plover) nesting and where no management activity, such as spraying or spraying and mowing, has occurred. These sandbars include sites at RMs 808.2, 807.6 (shoreline), 807.3, 807.2, 804.6, 804.5, 803.4, 802.5, 801.3, 791.5, 788.5, 779.2, 779.1, 779.0, 778.9, 777.5, 777.0, 776.4, 775.2, 764.5, and 760.0. In addition to these natural sandbars, there were also the created sandbars at RMs 770.2, 770.1, 770.0, 769.9, 761.3, 755.0, and 754.2. Table 34 shows the nest success for the treatment types.

Table 34. Piping Plover Nest Success by Treatment Type – Gavins Point River Segment 2007

Treatment Type	Total	Successful	Not Successful	Not Determined	% Successful	% of Total
Created	88	71	15	2	80.6	49.7
Not Treated	76	36	36	4	47.4	43.0
Spray	0	0	0	0	0.0	0.0
Spray and Mow	13	10	2	1	76.9	7.3
Total	**177**	**117**	**53**	**7**	**66.1**	**100.0**

The table shows the nest success was good for the piping plovers on the spray and mow sites, but, compared to the created and non-treated sites, the plovers did not use the treated sites to a great extent. Table 35 shows the productivity for the treatment types.

Table 35. Piping Plover Productivity by Treatment Type – Gavins Point River Segment 2007

Treatment Type	Adults	% of Total Adults	Fledglings	% of Total Fledglings	Fledge Ratio
Created	146	48.7	30	50.8	0.41
Not Treated	128	42.6	22	37.3	0.34
Spray	0	0.0	0	0.0	0.0
Spray and Mow	26	8.7	7	11.9	0.67
Total	**300**	**100.0**	**59**	**100.0**	**0.39**

The table shows that, while the plovers did not use the spray and mow sites as much compared to the created and non-treated sites, the piping plovers had a higher fledge ratio than those two habitat types. However, the fledge ratio of 0.67 was only a little more than half of the 2003 BiOp Amendment fledge-ratio goal of 1.22.

IV.C.5. Kansas River Piping Plovers

IV.C.5.a. Incidental Take

There were no piping plover adults, chicks, or eggs that were lost on the Kansas River in 2007 due to the Corps operations.

IV.C.5.b. Reasonable and Prudent Measures

RPM 1 – Survey and Monitor Piping Plover, Mortality, and Incidental Take

RPM 1.1 – Summary Data

In 2007, an adult census and productivity monitoring was conducted for piping plovers on the Kansas River. The adult census for piping plovers was zero. No plover nests were found on the Kansas River in 2007.

IV.D. Bald Eagle Summary

The bald eagle was reclassified as threatened in 1995 and was removed from the Federal threatened and endangered species list on August 8, 2007. However, the bald eagle is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, and the Corps will continue to follow the recommendations of the BiOp.

IV.D.1. Kansas City District

The Kansas City District awarded a contract to EA Engineering to conduct and write a Programmatic Environmental Assessment and Cottonwood Management Plan. In 2007, EA Engineering completed a literature search and review, concentrating on vegetation management plans, especially cottonwood

management plans prepared by other agencies and states. It also completed a literature search and review for the affected environment chapter of the environmental assessment, concentrating on resources directly applicable to the Cottonwood Management Plan and focusing on existing Missouri River documents.

EA Engineering assisted with organizing the Missouri River Cottonwood Management Plan/Programmatic Environmental Assessment Workshop, held August 20-24, 2007, in Yankton, South Dakota. The workshop was conducted by the Kansas City District, Engineer Research and Development Center, University of South Dakota (USD), South Dakota State University, and EA Engineering. A meeting summary can be found at: https://www.nwo.usace.army.mil/html/pd-e/workshop.html.

The Kansas City District awarded a contract to Carter Johnson Company to organize, conduct, analyze, and summarize vegetation sampling along seven segments [segments 2 (Fort Peck Dam to Lake Sakakawea Headwaters near Williston, North Dakota), 4 (Garrison Dam to Lake Oahe Headwaters near Bismarck, North Dakota), 6 (Oahe Dam to Big Bend Dam), 8 (Fort Randall Dam to Niobrara River), 9 (Niobrara River to Lewis and Clark Lake, and Lewis and Clark Lake), 10 (Gavins Point Dam to Ponca, Nebraska), and 13 (Platte River to Kansas City, Missouri)] of the Missouri River. Segment 2 is being sampled in addition to the six segments identified by the USFWS. This segment of river serves as a reference condition segment since it has not been altered dramatically. The Carter Johnson Company includes researchers, professors, and graduate students from USD, Benedictine College, and USGS.

During summer 2007, the USD team sampled overstory and understory vegetation on 17 forest stands within segment 8, 34 stands within segment 10, and 11 stands within segment 13. The USGS sampled four stands along the Wild and Scenic reach in Montana upstream, from Fort Peck Lake; worked on issues with field sampling methodology; and mapped 20 miles of the reach for young cottonwood stands. The Benedictine team sampled the forest vegetation of four sites in segment 13. The USD and Benedictine teams began to develop species lists and a collection of voucher specimens for their segments. The USD team also finished draft 1892 land cover GIS coverage for segments 2, 4, 6, 8, 9, and 10 and began on segment 13. USD finished draft 2006 land cover GIS coverage for all seven segments. They completed a draft map depicting cottonwood age classes within the floodplain on segment 10, using overlays of photographs or maps from the years 1892, 1956, 1980s, 1997, and 2006.

IV.D.2. Omaha District

Omaha District completed a draft monitoring plan and environmental assessment for the Little Bend River Restoration Project, a cottonwood forest restoration project on the Lower Brule Sioux Tribe Reservation in South Dakota. The project will include the planting of over 4,800 cottonwood seedlings and over 10,000 seedlings or plugs of native riparian tree, shrub, and vine species. On April 24, 2007, a poster presentation on the Little Bend project was delivered at the National Conference on Ecosystem Restoration in Kansas City, Missouri.

An agreement was coordinated with the NPS to have the NPS remove invasive Russian olive from a private property located near RM 775 along the MNRR. The Russian olives were competing with cottonwood seedlings for sunlight and nutrients on low ground along the river. In late August the NPS cut and treated the stumps of 202 Russian olives on 56 acres with Habitat herbicide. The NPS recorded the location of each stump with a GPS unit and will monitor the stumps over the next few years for resprouting.

A scope of work was also created for removing red cedars from 120 acres of cottonwood forest on the private property near RM 775. This work will be considered for the FY 2009 budget.

V. Public Involvement and Communication

V.A. Missouri River Recovery Implementation Committee

The Federal Working Group (FWG), made up of staff from the numerous Federal agencies with programs affecting the Missouri River, convened the MRRIC Charter Planning Group in early 2007. The FWG was appointed by the executives of the Missouri River Basin Interagency Roundtable in May 2006 and was tasked

with developing the framework for establishing the MRRIC. Following development of the framework, General Gregg Martin, commander of the Northwestern Division of the Corps, on behalf of the FWG, invited the chairpersons of basin Tribes and the governors of basin States to designate their personal representatives and alternates to participate in the Planning Group process. At the same time, the U.S. Institute for Environmental Conflict Resolution extended an open invitation to members of the public, nongovernmental stakeholders, and local governments in the basin to submit an application to participate in the process.

The MRRIC Planning Group consists of a Drafting Team and a Review Panel. These two different ways of participating in the Charter development process have involved different time requirements and degrees of commitment for working collaboratively with others in developing the recommended Charter for MRRIC.

Members of the Drafting Team have been working together to develop a recommended Charter for MRRIC. The Drafting Team has considered feedback, comments, and suggested improvements received from the Review Panel, from participants in public workshops, and from submitted public comments, prior to finalizing and forwarding a recommended Charter for MRRIC to the FWG and the Assistant Secretary of the Army for Civil Works on February 5, 2008.

The Drafting Team held monthly meetings in different locations in and near the basin. Participation on the Drafting Team required significant time, effort, and personal commitment.

Members of the Review Panel had a significant role in determining the final recommendations of the Drafting Team by providing them with feedback, comments, and suggested improvements on preliminary drafts of the recommended Charter for MRRIC. The Review Panel participated in joint meetings with the Drafting Team periodically.

Table 36. MRRIC Planning Group Meetings in 2007

Meeting	Date	Location
Drafting Team Meeting #1	March 28-29, 2007	Omaha, NE
Drafting Team Meeting #2 – with Review Panel	April 25, 2007	Kansas City, MO
Drafting Team Meeting #3	June 19-20, 2007	Minneapolis, MN
Drafting Team Meeting #4	July 19-20, 2007	Omaha, NE
Drafting Team Meeting #5	August 27-28, 2007	Billings, MT
Drafting Team Meeting #6	September 25-26, 2007	Minneapolis, MN
Drafting Team Meeting #7 – with Review Panel	October 17-18, 2007	Kansas City, MO
Drafting Team Meeting #8 – with Review Panel	November 28-29, 2007	Denver, CO
Drafting Team Meeting #9	December 19, 2007	Conference Call

The Planning Group was assisted and led by two co-chairs, appointed by the Federal executives of the Missouri River Basin Interagency Roundtable. Cheryl Chapman is an engineer from Rapid City, South Dakota. She has experience as an engineer, corporate director, elected official, and public administrator. She has also served as the Principal Deputy Assistant Secretary of the Navy for Installations and Environment. John Thorson is the Assistant Chief Administrative Law Judge with the California Public Utilities Commission in San Francisco, California. He has consulted on many water law issues throughout the country and has served as Special Master for Arizona's general stream adjudications. Both brought a wealth of knowledge and experience in collaborative activities on contentious issues.

With the assistance of the U.S. Institute for Environmental Conflict Resolution, the Planning Group selected a facilitation team headed by Ruth Siguenza to guide the group’s efforts.

The passage of WRDA 2007 on November 8, 2007, legislated the establishment of the MRRIC. WRDA 2007 set a requirement for the Secretary of the Army to “establish” MRRIC within 6 months of the date of enactment of the act. The legislation also provided duties and membership guidelines for MRRIC. While WRDA 2007

was not enacted until late into the Planning Group's work, the group had considered drafts of the legislation as it developed the recommended Charter language. The Planning Group believes that the recommended Charter satisfies WRDA 2007's requirements while providing additional detail, structure, and process guidelines for MRRIC's work.

The recommended Charter, drafted by a broadly representative committee of Missouri River basin residents, including participation by tribes, eight basin states, and diverse stakeholder interests, represents the persistence and dedication of this group to set aside past tensions and concerns to create a document that balances competing interests in the shared interest of creating a MRRIC that will succeed.

The Planning Group submitted the recommended Charter to the FWG and the Assistant Secretary of the Army for Civil Works on February 5, 2008.

For further information on the process, including the members of the Drafting Team and Review Panel, see the web site at http://missouririver.ecr.gov.

V.B. Information and Data Advisory Team

V.B.1. Introduction

The need for an IDA team was identified at the MRRP 2006 Annual Meeting in Nebraska City, Nebraska. The IDA team is comprised of personnel from Northwestern Division, Engineer Research and Development Center, Omaha District, Kansas City District, and contract personnel. IDA team's mission is to provide support and guidance to the MRRP for the effective collection, storage, and distribution of data, knowledge, and information to enable efficient communication and execution of program resources.

Initially, a PDT was formed. Then, the project tasker and charter was written and signed. The IDA team has set out to provide:

1. Avenues for communication and coordination;
2. Utilities for projects;
3. Data integration – standards;
4. Contract language;
5. Document templates and storage;
6. Management resource integration (P2, CEFMS, Real Estate); and
7. Data oversight/data compliance.

During FY 2007, the IDA team set out and defined a framework and infrastructure for the MRRP to use. Some initial actions were taken to improve the framework and infrastructure, and several tasks were completed to handle the immediate needs of the MRRP. The IDA team also took on the task of creating a draft website for the proposed National Center for Ecosystem Restoration (NCER) as members of their communications team. NCER was proposed to General Riley on December 13, 2007, to be a knowledge gateway connecting ecosystem restoration efforts across the Corps, the nation, and, ultimately, around the world. NCER's goal is to move the Corps forward as the leader in collaborative, holistic, and life-cycle approaches to ecosystem restoration.

V.B.2. Framework for Data Management

One of the first decisions to come out of the IDA team is that the framework would be "web centric and database driven." Having all the data and utilities available through a database and the web gives great flexibility and portability. The processing of data occurs on a centralized, dedicated server, where the business logic, rules, and security reside as close to the data as possible. There is no software that is required to be installed or maintained on the user's computer. This framework ensures that all clients are referencing the same application, model, or data. Lastly, it is all accessible from any computer on the internet.

The framework calls for all content to be database driven. All data is to be stored in a database. In this case, the database will be Oracle. Using Oracle provides the program consistency with existing Corps databases. It

is considered the best practice in the industry. It also ensures connectivity with others through web-services. Oracle also facilitates data/information versioning and back-up. The program will be able to provide role-based security to allow individual users, or groups of user's, rights to view, modify, and delete certain items in the database, based upon their given role.

V.B.3. Infrastructure

Enhancements to infrastructure in FY 2007 included improvements to the bandwidth for Omaha and Kansas City Districts. To improve the bandwidth, Multiple Protocol Labeling Service was implemented, and the available bandwidth to the districts was increased significantly. The Kansas City District also ordered and received additional servers to fulfill infrastructure needs.

The current plan for infrastructure is to have an Oracle/SDE Server in the Omaha District and a similar Oracle/SDE configuration in the Kansas City District. The data will be mirrored between two servers for continuity of operations and redundancy and to provide connectivity to the Northwestern Division servers. External customers will access data by the use of proxy servers at one or both locations. If access is slow through the proxy, other alternatives will be exercised. For example, the IDA team could increase or reallocate bandwidth for the Districts or access more bandwidth through a commercial co-location facility.

V.B.4. Product Development

During the course of the year, it became apparent that several products were needed for the program. These products were needed quickly, and the IDA team was put into action. There was a need to consolidate several web sites. There was a lack of a centralized public communication conduit. Kansas City District had a web site, Omaha District had some information on its web site, and the MRRIC had a separate web site. The MRRP needed one place the public could go for information. Thus, a draft public web site for the program was created in FY 2007. A web domain name was purchased, and the site was built using the proposed infrastructure and framework. The Uniform Resource Locator for the site is: http://www.moriverrecovery.org.

On another matter, it had become obvious that the current MRRP Team collaboration software, Groove, was inadequate to handle a team of the magnitude of the MRRP Team. The IDA team made a cursory evaluation of available alternatives and initiated the use of WebEx as the team collaboration software for the MRERP and MRRP.

MRRP Public Web site: http://www.moriverrecovery.org

MRRP Team Collaboration Web site: https://moriverrecovery.webexone.com

Future efforts of the IDA team in 2008 include:

1. Complete Project Management Plan;
2. Deploy the MRRP website;
3. Continue support for the NCER website;
4. Evaluate and plan for rollout of long-term collaboration software solution;
5. Stand-up and configure Kansas City District's servers;
6. Develop content management tool for MRRP website;
7. Deploy Project Work Request (PWR) tool;
8. Develop MRERP research compendium; and
9. Develop customer database for MRRIC.

V.C. Communications Plan

The MRRP methods of communicating were enhanced during the year and began with an internal and an external communication assessment survey conducted by a private contractor. The purpose of the survey was to determine the current relationships, organization, and communication activities. In addition, the data from the survey provided the MRRP Senior PDT with an understanding of the various perspectives about the perception of MRRP goals and objectives from the viewpoint of internal and external stakeholders. A total of 15 Corps

staff members were interviewed, and a total of 35 external stakeholders participated in the assessment. The assessment identified common themes for the Corps to address. The Corps committed to a January 2008 introduction of a new webpage devoted to the program, a quarterly newsletter, a program brochure, and development of email updates.

VI. Literature Cited

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